

**UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF NEW YORK**

IN RE: VALE S.A. SECURITIES
LITIGATION

No. 1:16-cv-00658-GHW

EXPERT REPORT OF JOHN D. FINNERTY, Ph.D.

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I. Qualifications

1. I am an Academic Affiliate at AlixPartners, LLP, a financial and operational consulting firm, where I was previously a Managing Director. I have extensive experience in securities valuation, business valuation, derivatives valuation, solvency analysis, damages calculations, and litigation support for matters involving securities fraud, breach of contract, commercial disputes, valuation disputes, solvency, fairness, and breach of fiduciary duty. I have testified as an expert in securities and other financial matters, broker hiring disputes, and valuation disputes, in federal and state court and in arbitration and mediation proceedings. I have also testified as an expert in bankruptcy court proceedings concerning the valuation of securities and businesses, the economics of debt-for-debt exchanges, and the fairness of proposed plans of reorganization.
2. Prior to joining AlixPartners, I was a Managing Principal at Finnerty Economic Consulting, LLC, which provided financial consulting and valuation services to law firms, corporations, industry associations, and government agencies. Prior to forming Finnerty Economic Consulting in 2003, I was a Managing Principal at Analysis Group, Inc., an economic consulting firm. Prior to joining Analysis Group, I was a Partner (non-audit) in the PricewaterhouseCoopers Financial Advisory Services Group. I have also held investment banking positions at Morgan Stanley, Lazard Frères, McFarland Dewey, and Houlihan Lokey Howard & Zukin. I previously served as a Director, Executive Vice President, Treasurer, and Chief Financial Officer of College Savings Bank, an FDIC-insured and New Jersey-chartered thrift institution.
3. I am a Professor of Finance at Fordham University's Gabelli School of Business, where I was the founding Director of the school's Master of Science in Quantitative Finance

Program. I was awarded early tenure in 1991, and I received the Gladys and Henry Crown Award for Faculty Excellence in 1997. I have published 16 books, including Corporate Financial Management, 5th ed., Project Financing, 3rd ed., and Debt Management, and I have published more than 120 articles and professional papers concerning corporate finance, fixed income, and business and securities valuation. I co-hold four patents on financial products, including a specially designed certificate of deposit that would pay the cost of the beneficiary's college education and a life insurance product that paid off in units of the specially designed certificate of deposit.

4. I have previously published a paper on the calculation of damages in securities fraud cases entitled, "An Improved Two-Trader Model for Measuring Damages in Securities Fraud Class Actions," which was published in the Spring 2003 issue of the Stanford Journal of Law, Business & Finance. I have also published a paper on the settlement amounts in securities fraud class actions, entitled, "Determinants of the Settlement Amount in Securities Fraud Class Action Litigation," which was published in the Summer 2006 issue of the Hastings Business Law Journal. I have extensive experience testing for market efficiency, performing loss causation analysis, and calculating damages in securities fraud cases.
5. My teaching and research deal mainly with corporate finance, investment banking, fixed income securities valuation, fixed income portfolio management, and the design and valuation of complex securities. My corporate finance and investment banking courses cover business valuation, securities valuation, public offerings of securities, and equity financing. I was inducted into the Fixed Income Analysts Society Hall of Fame in 2011.
6. I previously served as the Chair of the Trustees, President, and Director, and I am currently serving as a Trustee of the Eastern Finance Association, an academic finance organization. I

am a former Director of the Financial Management Association. I have served as the President and Director of the Fixed Income Analysts Society, an association of finance professionals based in New York City. I am a former editor of *Financial Management*, one of the leading academic finance journals, and a former editor of *FMA Online*. I am a former member of the editorial boards of the *Journal of Portfolio Management* and the *International Journal of Portfolio Analysis & Management* and a former associate editor of the *Journal of Applied Finance*.

7. I received a Ph.D. in Operations Research from the Naval Postgraduate School, an M.A. in Economics from Cambridge University, where I was a Marshall Scholar, and a B.A. in Mathematics from Williams College. Attached as **Appendix A** is a true and correct copy of my current resume, which lists all publications I have written or co-authored and includes a brief description of my trial and deposition testimony within at least the past four years.
8. I am being compensated at a rate of \$1,130 per hour for my work on this matter. I have been assisted in the preparation of this expert report by AlixPartners's staff working under my direction and supervision. I will also receive compensation based on the professional fees earned by AlixPartners in conjunction with their support of my work in writing this report. Neither my compensation nor AlixPartners's compensation is contingent on my findings or on the outcome of this matter.
9. The materials that I considered in coming to my opinions in this matter are referenced in this expert report and accompanying exhibits or are listed in **Appendix B** to this expert report.

II. Assignment

10. Bernstein Litowitz Berger & Grossmann LLP ("Counsel") has asked me to (1) perform a loss causation analysis and opine on whether the declines in the prices of Vale S.A.'s ("Vale" or

the “Company”) common stock American Depositary Receipts (“ADRs”) (“Vale Common ADRs”) and Vale’s preferred stock ADRs (“Vale Preferred ADRs”) on the alleged disclosure dates are attributable to and were substantially caused by identifiable news events related to the disclosure of the fraud allegedly committed by Vale during the period extending from May 8, 2014 through November 27, 2015, inclusive (the “Proposed Class Period”),¹ and (2) calculate the amount of damages per Vale Common ADR and per Vale Preferred ADR experienced by class members who purchased the Vale Common ADRs and the Vale Preferred ADRs during the Proposed Class Period.

III. Summary of Opinions

11. Based on my education, knowledge, and training in economics; my experience in performing loss causation and damages analyses in connection with securities class action matters; and my review of the case documents, company filings, and other information relevant to this matter, I have reached the following opinions to a reasonable degree of certainty in the financial economics profession after conducting appropriate studies, the results of which are described in this expert report:

- a. The Vale Common ADRs declined subsequent to the November 6, 2015, November 27, 2015, and December 18, 2015 disclosure dates (the “Disclosure Dates”) when the revelations of Vale’s false and misleading statements and omissions concerning Vale’s risk mitigation plans, policies, and procedures, and its responsibility for the Fundão Dam collapse were publicly disclosed.
- b. The abnormal returns on the Vale Common ADRs on November 6, 2015, November 30, 2017, and December 21, 2015, the first trading days following the

¹ Based on the *In re: Vale S.A. Securities Litigation Consolidated Amended Class Action Complaint*, April 29, 2016 (the “Complaint”), I understand that the Class Period specified in the Complaint is between November 7, 2013 and November 30, 2015, inclusive. However, I understand from Counsel that certain allegations in the Complaint have since been dismissed by the Court, and the proposed Class Period is now between May 8, 2014 and November 27, 2015. I further understand that the alleged misrepresentations and/or omissions that remain in this case occurred on May 8, 2014 and November 16, 2015, and the partial corrective disclosures that remain in this case occurred on November 6, 2015, November 27, 2015, and December 18, 2015. See also, *In re: Vale S.A. Securities Litigation, Memorandum Opinion and Order*, March 23, 2017.

public corrective disclosures, are -2.04 percent, -5.09 percent, and -4.77 percent, respectively. The abnormal return on November 6, 2015 is not statistically significant at the 10% level, whereas the abnormal returns on November 30, 2017 and December 21, 2015 are both statistically significant at the 5% level.

- c. The abnormal returns on the Vale Preferred ADRs on November 6, 2015, November 30, 2017, and December 21, 2015, are -0.65 percent, -8.63 percent, and -4.17 percent, respectively. The abnormal return on November 6, 2015 is not statistically significant at the 10% level, whereas the abnormal returns on November 30, 2017 and December 21, 2015 are both statistically significant at the 5% level.
- d. The abnormal returns on the Disclosure Dates were not due to any macroeconomic factors, industry-specific factors, or non-fraud-related Vale news, but were substantially caused by revelations of facts regarding the efficacy of Vale's risk mitigation plans, policies, and procedures, and the safety of Vale's operations and dams, and the financial impact on Vale when it was revealed that it could be held responsible for the Fundão Dam collapse.
- e. The amount of damages suffered by purchasers of the Vale Common ADRs and the Vale Preferred ADRs as a result of the disclosure of the truth about Vale on the Disclosure Dates is, in total, up to \$0.33 per Vale Common ADR and up to \$0.37 per Vale Preferred ADR.

12. These opinions are based on the results of the loss causation analysis and the damages calculations that are described in this expert report.²

IV. Background

A. Overview of Vale's Business During the Proposed Class Period

13. According to the Complaint, Vale is a mining company headquartered in Brazil with a presence in more than 30 countries, and Vale is one of the world's largest mining companies. It is the world's largest producer of iron ore and iron ore pellets and the world's second largest producer of nickel. Vale also produces manganese ore, coal, copper, gold, silver, and phosphates as well as other fertilizer nutrients. Vale's iron ore mines and related operations

² In reaching my opinions, I have been asked by Counsel to assume that the market for the Vale Common ADRs and the market for the Vale Preferred ADRs were both efficient during the Proposed Class Period. I have not been asked, nor do I provide, any opinions on market efficiency in this expert report.

are concentrated in the Southeastern, Southern, and Northern Systems of states in Brazil.³

14. In addition to the mines that Vale owns in Brazil, it also operates through Samarco Mineração, S.A. (“Samarco”), a privately held joint venture between Vale and BHP Billiton (“BHP”). Vale and BHP, the only shareholders of Samarco, each own a 50% controlling interest. Samarco conducts its operations principally at the Germano mining complex in Minas Gerais, which includes two mines, three beneficiation plants, three slurry pipelines, and several tailings dams, including the Fundão Dam, the Santarem Dam, and the Germano Dam. All three of Samarco’s dams are classified by the state environmental agency as Class III, an indication that they pose the greatest potential for environmental damage.⁴
15. Mining for iron ore generates an enormous amount of waste, and the process known as beneficiation produces a waste product known as tailings – a mixture of water, processing chemicals, and finely ground rock.⁵ The tailings dams, including the Fundão Dam, are used to store the tailings, a byproduct of the mining process.
16. On Thursday, November 5, 2015, late in the afternoon, the Fundão Dam collapsed, “unleashing a colossal torrent of mud and debris hurtling toward the villages below.”⁶ The dam collapse released mud and debris that destroyed virtually everything in its path, and 19 lives were ultimately lost, along with hundreds of homes destroyed. According to the Complaint, “[a]fter destroying Bento Rodrigues and seriously damaging several other nearby towns, the mudflow flooded the Rio Doce, killing fish and wildlife and polluting the water

³ Complaint, ¶ 25.

⁴ Complaint, ¶ 26.

⁵ Complaint, ¶ 33.

⁶ Complaint, ¶ 84.

all the way to the Atlantic Ocean 400 miles away.”⁷

B. Securities at Issue

17. During the Proposed Class Period, the Vale Common ADRs and the Vale Preferred ADRs traded on the New York Stock Exchange (“NYSE”) under the ticker symbols “VALE” and “VALE.P”, respectively.⁸ An ADR is a negotiable certificate that evidences an ownership interest in American Depositary Shares (“ADSs”), which, in turn, represent an interest in the shares of a non-US company that have been deposited with a U.S. bank. An ADR is similar to a stock certificate representing shares of stock.⁹ **Exhibits 1 and 2** provide the ADR price performance and trading volumes for the Vale Common ADRs and the Vale Preferred ADRs, respectively.
18. There were between 730 million and 846 million Vale Common ADRs outstanding, and between 602 million and 664 million Vale Preferred ADRs outstanding during the Proposed Class Period.¹⁰ Holders of the Vale Preferred ADRs have preferential treatment over the holders of the Vale Common ADRs; they receive an annual non-cumulative preferential dividend set equal to (i) at least 3% of the book value per share or (ii) 6% of the shareholder’s pro rata share of Vale’s paid-in capital, whichever is higher.¹¹ JPMorgan

⁷ Complaint, ¶ 84.

⁸ Vale’s SEC Form 20-F for year ended December 30, 2014, p. 113.

⁹ SEC Office of Investor Education and Advocacy, “Investor Bulletin: American Depositary Receipts,” August 2012, at 1.

¹⁰ Vale’s SEC Form 6-Ks for quarters ended March 31, 2014, June 30, 2014, September 2014, March 31, 2015, June 30, 2015, and September 30, 2015, and Vale’s SEC Form 20-Fs for years ended December 31, 2014 and December 31, 2015.

¹¹ Vale’s SEC Form 20-F for the year ended December 30, 2014, pp. 113 and 136. One common ADS represent one common share, and one preferred ADS represent one preferred share, and both are traded on the New York Stock Exchange under the ticker symbols VALE and VALE.P, respectively. Furthermore, to the extent Vale declares dividends in any particular year that exceed the preferential dividends on the preferred shares and after holders of the common shares have received distributions, holders of the common and preferred shares may receive the same additional dividend amount per share.

Chase Bank serves as the depository for both the Vale Common ADRs and the Vale Preferred ADRs.¹² The Vale Common ADRs and the Vale Preferred ADRs (collectively, the “Vale ADRs”) are the securities at issue in this litigation.

V. Defendants’ Allegedly False and Misleading Statements and Omissions

19. The Complaint in this matter alleges that Vale made a series of false and misleading statements and omitted material facts concerning Vale’s risk mitigation plans, policies and procedures, the safety of Vale’s operations and dams, and Vale’s control over Samarco’s operations and its responsibility for the harm caused by the Fundão Dam collapse. As a result, the prices of the Vale ADRs were artificially inflated on the first day of the Proposed Class Period by Vale’s allegedly false and misleading statements and/or omissions made that day, in which Vale failed to disclose material facts as set forth in the Complaint, and the prices of the Vale ADRs remained artificially inflated until subsequent revelations disclosed the truth to the market on the Disclosure Dates. The fact that the Vale ADR prices did not increase in a statistically significant manner on the days when the false and misleading statements and/or omissions were made does not necessarily indicate that no inflation resulted from the misstatements and/or omissions. Indeed, when a misleading statement or omission maintains market expectations or otherwise prevents a negative market reaction because the negative information was withheld from the market, the misstatement would not be expected to cause an immediate increase in the prices of the Vale ADRs.
20. The Complaint identifies both material misrepresentations and material omissions. The distinction between the two is economically important. Material misrepresentations will artificially inflate the price of a company’s stock (the stock price may go up in reaction to the

¹² Vale’s SEC Form 20-F for the year ended December 30, 2014, p. 113.

statements or an otherwise expected decline in the stock price may be mitigated as a result of the statements), as investors react to the falsely positive information in the belief that it is true and materially complete. Omissions of adverse information, on the other hand, artificially avoid the negative stock price reaction that would be expected to occur if the true and/or materially complete information were disclosed to investors. Both misrepresentations and omissions result in artificial stock price inflation: the misrepresentations (fraud by commission) trigger a price increase or mitigate an otherwise expected price decrease that would have occurred but for the fraud, and the omission of material negative information (fraud by omission) avoids a price decrease that would have occurred but for the fraud.

Exhibit 3 provides a list of the alleged misrepresentation and omission dates and the alleged corrective disclosure dates.

21. The alleged misrepresentation and omission dates are May 8, 2014 and November 16, 2015. A discussion of Vale's misrepresentations and omissions on these two dates follows.

A. Thursday, May 8, 2014

22. In April 2014, Vale publicly released its 2013 Sustainability Report.¹³ The 2013 Sustainability Report was also referenced in a press release that Vale filed with the SEC on May 8, 2014 on Form 6-K.¹⁴ According to the Complaint, the May 8, 2014 press release and its reference to the 2013 Sustainability Report contained false and misleading statements concerning Vale's risk mitigation plans, policies, and procedures, and the safety of Vale's

¹³ Complaint, ¶ 91. Vale's Sustainability Reports are published annually and are publicly disseminated on Vale's website.

¹⁴ Complaint, ¶ 91.

operations and dams.¹⁵

23. According to the Complaint, the 2013 Sustainability Report contained materially false and misleading statements from Defendants that assured investors that Vale “implements actions and measures to prevent, control or compensate for [environmental] impacts” and that it has “policies, systematic requirements and procedures designed to prevent and minimize risks and protect lives.”¹⁶ Specifically, the Complaint alleges that Defendants represented that Vale has developed “technical and operational procedures, control devices, qualified teams, specialist consultancies and period audits in order to identify, control and minimize the risks of its operations, and maintain tolerable levels[.]”¹⁷ In explaining that iron ore is disposed of in its tailings dams, Defendants acknowledged the risks of the structures, and reassured investors that Vale takes all steps necessary to “ensure that such structures are stable in order to control the risks of impacts”.¹⁸ Defendants also represented that Vale has “invested in processes, systems and tools for the automation of dams monitoring[.]” and that the “Vale dams are constructed and operated following strict safety standards and audited periodically

¹⁵ Complaint, ¶¶ 101-102. The Complaint also alleges that the May 8, 2014 press release contained materially false and misleading statements concerning Vale’s values and commitment to health, safety, and the environment. *See* Complaint, ¶¶ 99-100. However, I understand that the claims based on this set of challenged statements have been dismissed by the court. *See In re: Vale S.A. Securities Litigation, Memorandum Opinion and Order*, March 23, 2017, p. 39.

¹⁶ Complaint, ¶ 101.

¹⁷ Complaint, ¶ 101.

¹⁸ Complaint, ¶ 101.

to monitor and reduce all potential risks, including structural failures.”^{19, 20}

24. However, as alleged in the Complaint, the statements contained in the 2013 Sustainability Report were materially false and misleading because “among other things, the Fundão Dam did not follow strict safety standards; Vale did not have policies, systematic requirements and procedures to prevent and minimize risk and protect lives; and did not implement actions and measures so as to cause the least possible environmental impact,” as evidenced by the following alleged facts:²¹

- Defendants had been repeatedly warned about the Fundão Dam’s structural problems and potential for structural failure;
- Randal Fonseca, the Instituto Pristino, and Joaquim Pimenta de Ávila all warned of significant risks or deficiencies at the Dam and provided recommendations to mitigate potential risks. Defendants failed to implement these recommendations;
- Mr. Pimenta de Ávila recommended that the water pressure and water levels be

¹⁹ Complaint, ¶ 101.

²⁰ See also, *In re: Vale S.A. Securities Litigation, Memorandum Opinion and Order*, March 23, 2017, pp. 42-43, enumerating the statements that the Court concluded are not forward-looking in nature, but rather, representations of present or historical facts; and *In re: Vale S.A. Securities Litigation, Order*, May 26, 2017, pp. 1-2, clarifying that “no claims based on statements in Vale’s 2014 Sustainability Report or its 2013 and 2014 annual reports have survived.” Accordingly, I understand that the following alleged misstatements, all of which are found in the 2013 Sustainability Report (published on April 30, 2014), are still at issue:

- “[T]he company implements actions and measures to prevent, control or compensate for impacts.” *Id.* at p. 18.
- “[W]e have a set of policies, systematic requirements and procedures designed to prevent and minimize risks and protect lives.” *Id.* at p. 37.
- “In its management of environmental risks, Vale uses technical and operational procedures, control devices, qualified teams, specialist consultancies and periodic audits in order to identify, control and minimize the risks of its operations, and maintain tolerable levels....” *Id.* at p. 20.
- “Operations are planned and conducted so as to cause the least possible environmental impact.” *Id.* at p. 65.
- “Our commitment to environmental and social issues is also reflected in the way we manage specific kinds of waste in the production process.” *Id.* at p. 71.
- “Vale has also invested in processes, systems and tools for the automation of dams monitoring...” *Id.* at p. 72.
- “Vale dams are constructed and operated following strict safety standards and audited periodically to monitor and reduce all potential risks, including structural failures.” *Id.* at item 4.07.

²¹ Complaint, ¶ 102. Internal paragraph references to Complaint omitted from bullet points. I understand from Counsel this list of alleged facts is not exhaustive.

monitored daily, sworn testimony revealed that such monitoring was only done weekly and the monitoring system was no longer automatic due to interference caused by the ongoing work to raise the Dam; and

- Stability reports showed that several piezometers recorded emergency levels of water pressure in 2014 and 2015, including one that continuously recorded “emergency” levels between August 2014 and July 2015 and another between March and May 2015.

B. Monday, November 16, 2015

25. On Monday, November 16, 2015, eleven days after the Fundão Dam collapse, Vale held its first conference call with analysts and investors to discuss the financial impact of the dam collapse on Vale’s business. During the conference call, Defendant Pires stated the following:²²

With regards to the relationship between Vale, BHP and Samarco, let's remember that Vale and BHP, they compete with each other, and they also both compete with Samarco. So in compliance with applicable Brazilian and international competition regulations, we are prohibited to directly interfere in Samarco's management. And to that extent, I call your attention, especially to the EU, European Union antitrust law. So therefore, Samarco had an independent management and unlike other -- sometimes, other affiliates, there was no -- there were no resources shared between Vale and Samarco or BHP and Samarco, whatsoever. So we did not share systems. We did not share support functions. We did not share, not even in Mariana, where Vale and Samarco were neighbors, we did not share any type of operation crews or, let's say, safety technicians or communications people or community relations people. No, they were all completely independent.

26. According to the Complaint, the statements and omissions during the conference call were materially false and misleading, because among other things, Defendants knew or recklessly disregarded the following alleged facts:²³

- The contract that governs Vale’s right to dump waste in the Fundão Dam requires Vale to “share in the maintenance expenses of the current dam and construction and maintenance of new dams, as well as any environmental costs derived from the use of the SAMARCO dams[.]”

²² Vale S.A. Conference Call Transcript, November 16, 2015.

²³ Complaint, ¶ 109. Internal paragraph references to Complaint omitted from bullet points.

- Vale is a controlling shareholder of Samarco, occupied four of the eight seats on Samarco's Board, and Vale employees sat on Samarco's advisory committees, including the Operations Committee;
- Vale received hundreds of millions of dollars, in the form of dividends, from Samarco each year during the Class Period, and more than \$3 billion in dividends over the past 5 years;
- Samarco's pellet production accounted for 23% of Vale's total pellet production in 2014 and 2015;
- Vale conducted annual audits of Samarco's business and operations; and
- Vale and Samarco shared the use of the Fundão Dam and other tailings dams at the Germano mining complex.

27. According to the Complaint, Defendant Pires represented to investors during the conference call that the "practices that [Vale adopts] in [its] tailing dams' management systems are state of the art, as also they were in Samarco" and that "if we learn something from the investigation, we are open to adopt further security measures that may be found necessary after those causes are identified."²⁴

28. However, as alleged in the Complaint, the statements made during the November 16, 2015 conference call were materially false and misleading, as evidenced by the following alleged facts:²⁵

- The Fundão Dam had been plagued by problems from the very beginning, including structural problems that caused inadequate drainage, which ultimately led to its catastrophic collapse;
- The Company ignored repeated warnings about the dangerous condition of the Dam, and refused to follow numerous recommendations that would have assured the safety and stability of the Dam;
- The Company dramatically increased production without appropriately fortifying tailings storage facilities needed to store the proportional increase in wastes;

²⁴ Vale S.A. Conference Call Transcript, November 16, 2015.

²⁵ Complaint, ¶ 112. Internal paragraph references to Complaint omitted from bullet points.

- The Company authorized expansion of the Fundão Dam despite the many warnings of its instability and dangerous condition;
- There was no emergency action plan for the Fundão Dam; there were no alarms or sirens to warn people in the surrounding communities in the event of an emergency, there was no real training for Dam employees, and no effort to involve the community in developing a plan for how to respond to an emergency;
- The Company had failed to properly maintain and construct the Fundão Dam, despite its contractual obligation to do so;
- Acoustical piezometers at the Dam were not working because of technical problems;
- Piezometers connected to an online network for automated monitoring had to be read manually because of interference caused by the ongoing work to raise the Dam;
- There was no radar monitoring of the Dam according to Rafael Gomes and Wanderson Silva; and
- The structural risk mapping of the Fundão Dam had not been updated to reflect its significantly modified size, structure, and geometry, even though VogBR expressly had recommended that it be done back in 2014.

VI. Corrective Disclosures to the Allegedly False and Misleading Statements and Omissions and Loss Causation Analysis

29. For my loss causation analysis, I first calculated the abnormal returns on the Vale ADRs on each corrective Disclosure Date. In performing these calculations, I calculated the daily total return on the Vale ADRs, which is the daily percentage change in the price of each ADR, adjusted for any cash dividend distributions.
30. Second, for each of the corrective Disclosure Dates, I examined the information released to the market in connection with Vale's allegedly false and misleading statements and omissions by reviewing news articles, analyst reports, press releases, and any other public reports released on and around each of the corrective Disclosure Dates.
31. Third, I performed an event study to calculate the abnormal returns on the Vale ADRs on the corrective Disclosure Dates and then investigated the relationship between the changes in the

Vale ADR prices and the news events concerning Vale on the Disclosure Dates.²⁶ I reviewed the media databases for Vale-related news articles and securities analysts' reports released on and around each of the Disclosure Dates for my loss causation analysis, and I analyzed whether the statistically significant abnormal returns on the Vale ADRs on each of the Disclosure Dates could be attributed to the respective corrective disclosures.

32. Finally, I calculated the damages per Vale Common ADR and per Vale Preferred ADR on each of the Disclosure Dates based on each ADR's price reaction attributable to the disclosure of the alleged fraud. Typically, the corrective disclosures of misrepresentations or omissions occur in a series of corrective statements or revelations of truth, rather than in one distinct statement or revelation.

A. Calculation of Abnormal Returns on the Vale ADRs

33. In order to quantify the impact of the company-specific news on the price of a security, one calculates the security's abnormal return in response to the announcement. A security's abnormal return is the difference between the security's actual return and its expected return. A security's expected return is the return one would expect based on general stock market price movements and industry-related factors that are unrelated to the specific event that is being examined, as reflected in the changes in the prices of stocks of firms in the same industry. The expected return is computed by applying a market model. Once one has calculated the security's abnormal return, one can use standard statistical tests to test whether

²⁶ An event study is a standard statistical technique that financial economists use to determine whether a security's price reaction to a news announcement (or some other event) is statistically significant. It is consequently the standard analytical technique that financial economists use to assess the stock market's reaction to news. The new information is the 'event', and generally, the one-day change in the issuing company's stock price the day the information is released into the market (or the next trading day if the information is disclosed publicly while the market is closed) indicates the stock market's assessment of the information's economic significance.

the abnormal return is statistically significant.

34. I calculated the expected returns on the Vale ADRs by applying the widely accepted Fama-French Three-Factor Model.²⁷ Eugene Fama and Kenneth French developed what is now known as the Fama-French Three-Factor Model in 1993.²⁸ The Fama-French Three-Factor Model expresses the excess return on a common stock on day t (R_t) over the return on Treasury bills that day (R_F) in terms of three key factors. The return on Treasury bills represents the return one would expect on a risk-free investment. This model “has become widely known and adapted.”²⁹ The model identifies the following three factors that explain excess stock returns:

- $R_{USM} - R_F$ (Market Risk Premium) – the excess return on the U.S. equity market portfolio (R_m) over the return on Treasury bills (R_F);³⁰
- SMB (“small minus big”) – the difference between the returns on small-capitalization stocks and the returns on large-capitalization stocks; and
- HML (“high minus low”) – the difference between the returns on high book-to-market stocks (commonly known as value stocks) and the returns on low book-to-market stocks (commonly known as growth stocks).

35. The regression formula for the Fama-French Three-Factor Model, which is fitted to daily data, is:

$$R_t - R_F = \beta_0 + \beta_1(R_{USM} - R_F) + \beta_2(SMB) + \beta_3(HML) + \epsilon \quad (\text{Equation 1})$$

36. The variables $R_{USM} - R_F$, SMB , and HML are defined above. The coefficients β_1 , β_2 , and

²⁷ Fama, Eugene F., and Kenneth R. French, “Common Risk Factors in the Returns on Stocks and Bonds,” *Journal of Financial Economics*, 33, 1993, pp. 3-56.

²⁸ Fama, Eugene F., and Kenneth R. French, “Common Risk Factors in the Returns on Stocks and Bonds,” *Journal of Financial Economics*, 33, 1993, pp. 3-56.

²⁹ Emery, Douglas R., John D. Finnerty, and John D. Stowe, Corporate Financial Management, 4th ed., Wohl Publishing, Morristown, NJ, 2011, p. 191.

³⁰ The equity market portfolio return, R_{USM} , represents the value-weighted return on all NYSE, AMEX and NASDAQ stocks in the U.S. equity market.

β_3 measure the contributions of the respective factors to the excess return on the stock, $R_t - R_F$. A positive coefficient suggests that the factor and the return on the analyzed stock tend to move in the same direction. The larger the coefficient, the more responsive the stock's return will be to that factor on any given day. The Fama-French Three-Factor Model has become widely accepted for event study analysis.³¹ It is a significant improvement over the (unadjusted) Capital Asset Pricing Model ("CAPM") because it prices the risks associated with small firm size and financial distress.³²

37. Morningstar's *Cost of Capital Yearbook*, which has been widely relied upon for historical rate of return data in the investment management industry, uses the Fama-French Three-Factor Model, among other models, to calculate the cost of equity capital for firms in various industries.³³ The Morningstar *Cost of Capital Yearbook* was discontinued after 2013 and replaced by the Duff & Phelps *Valuation Handbook*, which also employs the Fama-French Three-Factor Model, among other models, to calculate the cost of capital.³⁴
38. Controlling for industry factors that can affect the price of a company's stock is appropriate in an event study, as several articles in the academic and professional literature have

³¹ See, for example, Boehme, Rodney D., and Sorin M. Sorescu, "The Long-run Performance Following Dividend Initiations and Resumptions: Underreaction or Product of Change," *Journal of Finance*, 57, 2002, at 871-900, and Ang, James S., and Shaojun Zhang, "An Evaluation of Testing Procedures for Long Horizon Event Studies," *Review of Quantitative Finance and Accounting*, 23, 2004, at 251-274. Eugene Fama also won the Nobel Prize in Economics in 2013. "Eugene F. Fama – Facts," Nobelprize.org. Nobel Media AB 2014. Available at http://www.nobelprize.org/nobel_prizes/economic-sciences/laureates/2013/fama-facts.html.

³² Emery, Douglas R., John D. Finnerty, and John D. Stowe, Corporate Financial Management, 4th ed., Wohl Publishing, Morristown, NJ, 2011, at 192.

³³ Morningstar, Cost of Capital 2013 Yearbook, 2013, at 12.

³⁴ Duff & Phelps, 2014 Valuation Handbook, Industry Cost of Capital, at 6.

previously noted.³⁵ Indeed, academic research has pointed out the importance of making sure that estimates of returns to investors on securities are free of the bias that can occur with the omission of an explanatory factor when using a market model, such as the CAPM or the Fama-French Three-Factor Model, to conduct an empirical study.³⁶

39. Although the Vale ADRs are traded in the U.S. on the NYSE, Vale, which is headquartered and operates its business in Brazil, is also exposed to the Brazilian equity markets as well as the Brazilian Real / U.S. Dollar exchange rate. Accordingly, it is also appropriate to control for these two additional factors when analyzing the returns on the Vale ADRs.
40. A multiple regression model is estimated using an estimation period that is ideally untainted by fraud and comparable to the event period (*i.e.*, Proposed Class Period).³⁷ However, the Vale ADRs exhibited unusually heightened volatility during the Proposed Class Period. As shown in **Exhibits 4 and 5**, the price volatility of the Vale ADRs during the Proposed Class Period was approximately fifty percent higher than the volatility during the one-year period

³⁵ Tabak, David I., and Frederick C. Dunbar, "Materiality and Magnitude: Event Studies in the Courtroom," in Roman L. Weil, Michael J. Wagner, and Peter B. Frank, eds., Litigation Services Handbook, 3rd ed., Wiley, New York, 2001, chapter 19. See also Alexander, Janet C., "The Value of Bad News," *UCLA Law Review*, 41, August, 1994, at 1421-69; Macey, Jonathan R., Geoffrey P. Miller, Mark L. Mitchell, and Jeffry M. Netter, "Lessons from Financial Economics: Materiality, Reliance, and Extending the Reach of Basic v. Levinson," 77 *Virginia Law Review Association*, 1017, August 1991, at 1021-28; MacKinlay, A. Craig, "Event Studies in Economics and Finance," *Journal of Economic Literature*, 35, March 1997, at 13-39; Mitchell, Mark L., and Jeffry M. Netter, "The Role of Financial Economics in Securities Fraud Cases: Applications at the Securities and Exchange Commission," *The Business Lawyer*, 49, February 1994, at 545-90; and Cornell, Bradford, and R. Gregory Morgan, "Using Finance Theory to Measure Damages in Fraud on the Market Cases," *UCLA Law Review*, 37, June 1990, at 883-923.

³⁶ Bartholdy, Jan, and Paula Peare, "Unbiased Estimation of Expected Return Using CAPM," *International Review of Financial Analysis*, 2003, at 69-81. The article specifically mentions the CAPM but its analysis applies equally to the Fama-French Three-Factor Model because that model is really just an extended version of the CAPM. See Brealey, Richard A., Stewart C. Myers, and Franklin Allen, Principles of Corporate Finance, 9th ed., McGraw-Hill, New York, 2008, at 225-227.

³⁷ For event studies, there are four choices for the estimation period, (1) before the event period, (2) during the event period, (3) after the event period, or (4) around the event period. See Glenn V. Henderson, Jr., "Problems and Solutions in Conducting Event Studies," *Journal of Risk and Insurance*, 57, 1990, at 282-306.

immediately preceding the Proposed Class Period.³⁸ Consequently, it is my opinion that due to the substantially elevated volatility during the Proposed Class Period, it is more appropriate to use the Proposed Class Period than the one-year period prior to the Class Period as the estimation period for fitting the stock price model. It is also my opinion that due to the even more substantially elevated volatility during the one-year period following the Class Period, it is more appropriate to use the Proposed Class Period than the one-year period following the Class Period as the estimation period for fitting the stock price model.

41. Using the Proposed Class Period as the estimation period provides a better fit for the purpose of estimating the Vale ADR abnormal returns during the Proposed Class Period. The elevated volatility can cause the hypothesis tests using standard event study procedures to become mis-specified if the one-year period prior to the Proposed Class Period is used as the estimation period.³⁹ When there is a substantial increase in the variance of the security's returns during the event window, using a non-event estimation period to estimate the variance during the event period will lead to biased test results because the variance will be understated. This bias will result in excessive rejections of the null hypothesis that the excess return is equal to zero.
42. However, when using the event period to fit the model, it is also necessary to isolate the effects of any alleged fraud on the security's price prior to calculating the security's abnormal returns. In order to minimize any potential impact of fraud-related dates on the

³⁸ Specifically, the volatility of the Vale Common ADRs was 33.6% the year prior to the Proposed Class Period, and 52.4% during the Proposed Class Period. Similarly, the volatility of the Vale Preferred ADRs was 34.0% the year prior to the Proposed Class Period and 49.4% during the Proposed Class Period. The volatility after the Proposed Class Period is also substantially higher than in both earlier periods.

³⁹ See Brown, Stephen J., and Jerold B. Warner, "Using Daily Stock Returns – The Case of Event Studies," *Journal of Financial Economics*, 14, 1985, pages 3-31. See also Kenneth R. Ahern, "Sample selection and event study estimation," *Journal of Empirical Finance*, 16, 2009, pages 466-482.

regression parameter estimates, I also drop the days when the allegedly false and misleading statements and omissions were made, as well as the days when the corrective disclosures were made, when fitting the regression model.⁴⁰ **Exhibit 3** provides a list of the remaining fraud-related news event dates at issue in this matter.

43. I modified the Fama-French Three-Factor Model to include the following additional explanatory factors:

- R_{IND} (Industry Return) – the daily total return on the S&P Metals and Mining Select Industry Index;⁴¹
- R_{BM} (Brazil Equity Market Return) – the daily return on the Index Bovespa, reconstituted without Vale;⁴² and
- R_{FX} (Brazilian Real / U.S. Dollar) – the daily return on the Brazilian Real / U.S. Dollar foreign exchange rate.

44. The coefficients β_4 , β_5 , and β_6 measure the contributions of the industry return, Brazil equity market return, and Brazilian real/U.S. dollar exchange rate factors, respectively, as defined above to the excess return on the Vale ADRs, $R_t - R_F$. The regression formula for my Modified Fama-French Three-Factor Model is:

$$R_t - R_F = \beta_0 + \beta_1(R_{USM} - R_F) + \beta_2(SMB) + \beta_3(HML) + \beta_4(R_{IND}) + \beta_5(R_{BM}) + \beta_6(R_{FX}) + \epsilon \quad (\text{Equation 2})$$

⁴⁰ Specifically, I excluded two alleged misrepresentation and omission dates (May 8, 2014 and November 16, 2015), and two partial corrective disclosure dates (November 6, 2015 and November 30, 2015) from the regression model. Although December 18, 2015 (effective trading day on December 21, 2015) is also identified as a partial corrective disclosure date, this date fell outside the Proposed Class Period, and as such, does not impact my estimation period.

⁴¹ The S&P Metals & Mining Select Industry Index (SPSIMMTR Index) is managed by S&P Dow Jones Indices LLC and is a modified equal-weighted index that is designed to measure the performance of stocks in the S&P Total Market Index that both (i) are classified under the Global Industry Classification Standard (GICS) in the aluminum, coal & consumable fuels, copper, diversified metals & mining, gold, precious metals & minerals, silver or steel sub-industries and (ii) satisfy one of the float-adjusted market capitalization (FAMC) and float-adjusted liquidity ratio (FALR) requirements. **Appendix C-1** contains a list of the members of the SPSIMMTR Index during the Proposed Class Period.

⁴² The Bovespa Index is adjusted to exclude Vale S.A. common and preferred stocks from the index. It represents the gross total return index weighted by free float market cap comprised of the most liquid stocks traded on the Sao Paulo Stock Exchange. **Appendix C-2** contains a list of the members of the Bovespa Index, excluding Vale, during the Proposed Class Period.

45. I also conducted a structural breakpoint test on the regression model to test whether there is a statistically significant change in the sensitivities of the estimation parameters during the Proposed Class Period. I performed a standard procedure called a Chow test on the following two sub-periods:

- (1) from May 8, 2014 (the first day of the Proposed Class Period) to May 11, 2015 (the day prior to Moody's issuing a negative outlook for Vale), and
- (2) from May 12, 2015 (the date when Moody's issued a negative outlook for Vale)⁴³ to November 27, 2015 (the end of the Proposed Class Period.)

46. I found that the regression coefficients for the two sub-periods are statistically significantly different from each other at the 1% level.⁴⁴ Accordingly, I found it appropriate to apply the Modified Fama-French Three-Factor Model to two sub-periods, rather than to the entire Relevant Period, in order to account for the structural break.

47. I applied the Modified Fama-French Three-Factor Model on the days when the false and misleading statements and omissions were made, and on each corrective Disclosure Date, to test whether the Vale ADRs' market reactions were statistically significant. **Exhibits 6 and 7** provide the fits of the regression models and the estimated abnormal returns on the relevant dates. In each case, I used a two-tailed test of statistical significance to test whether the daily abnormal return on the Vale ADR is zero (the null hypothesis) against the alternative

⁴³ "Moody's changes Vale's outlook to negative; affirms all ratings," *Bloomberg News*, May 12, 2015 (8:09 p.m. ET).

⁴⁴ See **Appendix C-3** for the results of the Chow test. I also conducted a Levene test, a statistical procedure to test whether the variances of two data series are equal, on the abnormal returns for the two sub-periods but did not find the variances for the two sub-periods to be statistically significantly different from each other at the 10% level. For comparison purposes, the regression results using the one-year pre-class period are presented in **Appendix C-4** and **Appendix C-5**, and the regression results without implementing a structural break during the Proposed Class Period are presented in **Appendix C-6** and **Appendix C-7**.

hypothesis that the daily abnormal return is different from zero (the alternative hypothesis).⁴⁵

48. I distinguish when the abnormal stock return is significantly different from zero at the 1% significance level (highly statistically significant), 5% level (statistically significant), or 10% level (weakly statistically significant). Academic articles in the financial economics literature typically cite all three levels of statistical significance but place the most weight on statistical results that are significant at the 1% level, less weight on those that are significant at the 5% level, and even less weight on those that are only significant at the 10% level.⁴⁶
49. After calculating the abnormal returns for each of the corrective Disclosure Dates, I investigated the impact of any potential confounding news that may have been released contemporaneously. Confounding news consists of economically significant Company-specific news announcements that are unrelated to the alleged fraud. Parsing out the effects of any confounding news on the Company's stock price is an essential and necessary step in calculating the amount of damages due to the alleged fraud.
50. Additionally, when there are multiple allegations and the truth concerning the multiple allegations is disclosed on the same day, disaggregating the impact of each allegation at issue on the Company's stock price on the disclosure date is also necessary to calculate damages incurred due to the alleged fraud. In this matter, the allegations concern Vale's allegedly false and misleading statements and omissions regarding Vale's risk mitigation plans, policies, and procedures, the safety of Vale's operations and dams, and Vale's responsibility

⁴⁵ The two-tailed test is conservative because I would normally expect that a corrective disclosure would elicit a negative stock market reaction, in which case the alternative hypothesis is that the abnormal stock market return is less than zero, and a one-tailed test would seem more appropriate. Thus, the two-tailed test with a 10% critical significance level is equivalent to a one-tailed test with a more conservative 5% critical significance level.

⁴⁶ A statistical significance level of 1%, 5%, and 10% means that there is less than 1 in 100, 1 in 20, and 1 in 10 chance, respectively, that the abnormal return happened by mere chance.

for the Fundão Dam collapse.

B. Partial Corrective Disclosures Specified in the Complaint

i. Thursday, November 6, 2015

51. On Thursday, November 5, 2015, at approximately 3:20 p.m. Eastern Time, the Fundão Dam collapsed.⁴⁷ According to the Complaint, the dam burst “releasing a massive wave of toxic sludge into the nearby river valley and causing severe flooding and 19 deaths. The collapse caused the equivalent of 20,000 Olympic swimming pools of mud waste to bury a small town of 600 people and affected more than a dozen riverside towns and cities on its way to the Atlantic Ocean. Within two hours, the tailings of iron ore reached the Rio Doce, a river basin that provides portable water to 230 municipalities. Over 250,000 people were left without clean drinking water.”⁴⁸ Shortly after the collapse, Samarco said in a brief statement on its website that “[i]t is not possible at this time to confirm the causes and extent of the incident.”⁴⁹
52. On Friday, November 6, 2015, various news outlets and securities analysts continued to cover this tragic event. Bloomberg reported that the accident will cause Vale significant losses as the company may have to pay for lives lost as well as for environment and city damages, according to an equity analyst at UM Investimentos.⁵⁰ The dam had been deemed “totally safe” by authorities in July, according to the owner, and a statement by Samarco in its Facebook account noted that it also performs its own inspections according to federal

⁴⁷ “Mining Company Samarco’s Dam Bursts in Brazil,” *The Wall Street Journal*, November 5, 2015 (Updated 7:19 p.m. ET). The accident was reported to have occurred around 4:20 p.m. local time in Brazil, or 3:20 p.m. ET.

⁴⁸ Complaint, ¶ 137.

⁴⁹ “Mining Company Samarco’s Dam Bursts in Brazil,” *The Wall Street Journal*, November 5, 2015 (Updated 7:19 p.m. ET).

⁵⁰ “Vale Slumps Most on Ibovespa After Dam Rupture,” *Bloomberg News*, November 6, 2015 (10:09 a.m. ET).

safety laws.⁵¹ Samarco also said in a statement that the waste material, known in the industry as tailings, is mostly silica from iron ore processing and doesn't contain chemicals that are harmful to health.⁵² A securities analyst from BTG Pactual remarked that "[i]t's still far too premature to come out with any concrete conclusions, and we still wait for further investigations and a position from Vale to better understand implications," noting that "[t]here are still a lot more questions than answers."⁵³

53. Securities analysts at HSBC Securities reported that "Samarco hasn't determined the cause of the accident or its extent yet" but that "[t]his accident brings a downside risk to [their] estimates as Samarco should face non-recurrent costs related to damage control measures; negatively impacting Vale's results and [cash flows] (via dividends received)."⁵⁴
54. Securities analysts at Itaú BBA similarly reported that "[a]lthough few details were provided, [they believed] that the tragic accident could have a negative impact on Vale's short term share performance, given that i) it may curtail the short-term pellet production, which could force Samarco to purchase iron ore from third parties at a higher cost than its own ore in order to maintain the production levels; ii) the rebuilding of the tailing dam will require capex; and iii) Samarco may have to offer compensation for the potential damages caused by

⁵¹ "Dams Deemed Safe 4 Months Before Deadly Spill, Brazil Miner Says," *Bloomberg News*, November 6, 2015 (7:57 a.m. ET).

⁵² "Dams Deemed Safe 4 Months Before Deadly Spill, Brazil Miner Says," *Bloomberg News*, November 6, 2015 (7:57 a.m. ET).

⁵³ "BHP and Vale Fall as Investors Count Cost of Brazil Dam Disaster," *Bloomberg News*, November 6, 2015 (2:41 p.m. ET).

⁵⁴ Leonardo Shinohara, et al., "Buy: Tailing dam accident should hurt Vale's results," *HSBC Securities*, November 6, 2015 (12:00 a.m. ET.) Timestamp sourced from S&P Capital IQ.

the accident.”⁵⁵ However, the securities analysts believe that these negative impacts could be somewhat mitigated by the company’s insurance plan.

55. Securities analysts at Morgan Stanley also highlighted Samarco’s contribution to Vale, and their initial response to the collapse, noting the following:⁵⁶

Under IFRS, Vale does not consolidate Samarco, but in 9M15 Vale received \$146M in dividends from the jointly controlled JV. Samarco contributed ~\$167M to Vale’s equity income during that period. On an equity basis, Samarco represents ~4% of Vale’s iron ore production and ~23% of its pellet output.

...

We’ll await a release from the company to confirm the cause and potential duration of output interruption, but would not be surprised if it lasted more than several months. In addition to this there will be remediation requirements; in this regard also we also look forward to a company release for details and whether there is any insurance coverage that may apply. Note that Samarco, and not Vale directly, should have the legal responsibility for any potential liability resulting from the accident.

56. Market participants and securities analysts believed the accident would negatively affect Vale’s pellet production and the likelihood that Vale would continue receiving dividends from Samarco. However, the initial view was that Vale’s exposure would be limited as these participants believed that Samarco, and not Vale directly, would bear the legal responsibility for any potential liability from the accident. The cause of the accident was still under investigation at the time, and the extent of Samarco’s and Vale’s insurance coverages was still unclear, but market participants posited that insurance coverage would mitigate the negative impact of the dam collapse and related fallout on Samarco and Vale.
57. Other securities analysts’ reports released in the following days expressed mixed reactions in

⁵⁵ Marcos Assumpção, CFA, et al., “First Take on Accident at Samarco Dam,” *Itaú BBA*, November 6, 2015 (3:06 p.m. ET.) Timestamp sourced from S&P Capital IQ. Notably, the securities analysts made no mention that Vale (or BHP) may have to offer compensation for the potential damages caused by the accident.

⁵⁶ Carlos De Alba, et al., “Unfortunate Samarco Tailings Dam Accident,” *Morgan Stanley*, November 6, 2015 (8:21 p.m. ET.) Timestamp sourced from S&P Capital IQ.

light of the uncertainties over the cause of the accident, whether Vale could or would be held liable, and to what extent insurance coverage would mitigate these negative impacts.

Securities analysts at Jefferies LLC, for example, remarked over the weekend on Saturday, November 7, 2015, that BHP and Vale are good operators and that accidents can happen, noting the following:⁵⁷

BHP and Vale are good operators who consider safety to be a top priority. Tailings dams do fail sometimes, and accidents can happen even for those miners that take safety the most seriously. A disaster of this magnitude, however, is likely to have a long-term negative impact on the reputations of these two companies.

58. Securities analysts at Deutsche Bank commented on Tuesday, November 10, 2015, that all efforts have been focused on the humanitarian issue, and “[a]s a result, understandably, there has been little in the way of information on the financial implications of the tragedy.”⁵⁸ The securities analysts noted that their initial estimate of a \$1 billion bill remained reasonable, and they stated that Samarco’s standard industry insurance policies “appear to cover the cost of cleaning up the disaster and the required capex on the repair work.”⁵⁹ The securities analysts noted however, that “[w]hat is less clear is how much of the indemnity insurance of \$1.2bn for 2015 will cover in terms of lost income between now and the (expected) return to normalized production.”⁶⁰ The following key issues that required further clarification were

⁵⁷ Christopher LaFemina, CFA, et al., “A Dark Cloud Over BHP Billiton and Vale,” *Jefferies LLC*, November 7, 2015 (3:00 p.m. ET.) Timestamp sourced from S&P Capital IQ. The securities analysts also expressed their views that “[t]here is a great deal of uncertainty regarding the production outlook for Samarco, but [they] expect the operation to be closed for an extensive period (could be years). The total cost to BHP and Vale is also highly uncertain... The uncertainty regarding cleanup and legal costs is likely to be an overhang on these shares.”

⁵⁸ Wilfredo Ortiz, et al., “Samarco – attempting to put context to financial impact,” *Deutsche Bank Securities Inc.*, November 10, 2015 (10:25 p.m. ET.) Timestamp sourced from S&P Capital IQ.

⁵⁹ Wilfredo Ortiz, et al., “Samarco – attempting to put context to financial impact,” *Deutsche Bank Securities Inc.*, November 10, 2015 (10:25 p.m. ET.)

⁶⁰ Wilfredo Ortiz, et al., “Samarco – attempting to put context to financial impact,” *Deutsche Bank Securities Inc.*, November 10, 2015 (10:25 p.m. ET.)

also highlighted for investors:⁶¹

- Will the insurance policy compensate Samarco for the cost of rebuilding, clean up costs, lost cash flows and any potential litigation costs? (Figure 1 suggests it will on capex, but not clear on lost revenues).
- Will shareholders stand-by Samarco in the event that funding is required to cover the losses associated with the tragedy, the commitments made and any debt servicing which may be affected by the lack of operating cash flow? In our view, morally and financially they will not hesitate and we expect that most of it will be covered by insurance.
- What are the implications for the balance sheet and the dividend policies of Samarco's shareholders? Limited on our base case.
- What is the long-term outlook for Samarco in terms of its current ownership structure? Potentially under review for BHP medium-term.

59. The securities analysts at Deutsche Bank initially estimated that the costs of reconstruction, environmental clean-up, litigation, among other costs, would total up to \$1 billion, which they viewed to be reasonable. They also expressed their view that “[i]nitial indications suggest no reason to believe this should not be covered by insurance.”⁶²
60. Securities analysts at Morgan Stanley, however, cautioned on Tuesday, November 10, 2015, that other parties (direct and indirect parties) may be implicated, including Vale and BHP, noting the following:⁶³

Based on our conversations, we believe that in the coming weeks Samarco will likely face injunctions as prosecutors at both the state and federal levels request that its bank accounts and/or other assets be frozen; this is likely to be followed by lawsuits from individuals or/and groups. We understand that the total amount/value of the potential liabilities (remediation costs + indemnification costs + fines) will be determined by

⁶¹ Wilfredo Ortiz, et al., “Samarco – attempting to put context to financial impact,” *Deutsche Bank Securities Inc.*, November 10, 2015 (10:25 p.m. ET.)

⁶² Wilfredo Ortiz, et al., “Samarco – attempting to put context to financial impact,” *Deutsche Bank Securities Inc.*, November 10, 2015 (10:25 p.m. ET.) The securities analysts however, are still looking to confirm with BHP and Vale, on their interpretation on their insurance coverage, noting the following questions: “Does the asset cover extend to clean-up and litigation claims? How does the indemnity limit of \$1.2bn for 2015 work beyond 2016? Is the \$1.2b the limit for the first 12-months of any claim, does it decline after that? Is it time weighted (i.e. \$100m per month?) Does the lost earnings coverage extend to the full \$1.2bn? (not clear)”

⁶³ Carlos De Alba, et al., “Samarco Accident: What is Next?,” *Morgan Stanley*, November 10, 2015 (3:04 a.m. ET).

experts' reports during the process. We see three main legal fronts that the case could follow:

- *Civil charges*: the broadest and most extensive front, this is likely to include charges for all remediations, environmental damage (and irreparable damage), and impact to the people/town. Based on other recent cases, our legal advisors believe it is very likely that prosecutors will charge direct and indirect parties as responsible for the accidents. This means that Samarco, Vale, and BHP are likely to be charged, and eventually the financial institutions that financed the construction of the ruptured dams could also be charged. Further, third parties' responsibility for the accident, or even acts of God (such as an earthquake) are unlikely to exempt the parties from being charged with accountability for the accident. Companies have no near-term protections against civil charges and due to its broad profile, it is very hard to estimate the amount of the eventual charges. The case could take many years to be resolved, taking place in several different court jurisdictions, and judging from similar past events, there is a significant chance that it will end by a settlement among the parties involved.
- *Administrative charges*: if authorities substantiate that the cause of this accident was due to a third party's action, charges could be relatively limited.
- *Criminal charges*: this charge would be applicable if evidence exists that the JV knew or ought to have known that the facility was impaired, or acted wilfully resulting in its impairment.

61. The daily returns on the Vale Common ADRs and the Vale Preferred ADRs were -5.69 percent and -4.12 percent, respectively, on Friday, November 6, 2015. The respective daily abnormal returns were -2.04 percent and -0.65 percent for the Vale Common ADRs and the Vale Preferred ADRs, respectively. Both abnormal returns are not statistically significant at the 5% level. (See **Exhibits 6 and 7**.)
62. While I would normally expect a statistically significant negative abnormal return on the Vale Common ADRs and the Vale Preferred ADRs on Friday, November 6, 2015, I note that the market's overall reaction was largely muted for the following reasons. First, securities analysts expressed their initial reactions that the negative financial impact on Samarco (and ultimately Vale through its 50% ownership) could be mitigated by insurance coverage. Furthermore, Vale continued to represent to shareholders that Samarco, and not Vale (or

BHP), will bear responsibility for the accident.^{64, 65} Second, while the cause of the accident was still under investigation, market participants were not fully aware that (1) Vale had been using the Fundão Dam for its own waste, and thus could be held responsible as both a direct

⁶⁴ *The Wall Street Journal* noted that “[b]oth Vale and BHP Billiton have said the joint venture bears responsibility for the accident, which occurred when a pair of giant, earthen walls holding back lakes of water and mining waste known as tailings unexpectedly collapsed. But many in Brazil disagree, and Vale, in particular has come under heavy criticism for what has been perceived as a weak public response. Mariana Mayor Duarte Gonçalves said in an interview that he sees Samarco’s parent companies as ultimately responsible for the catastrophe. ‘Samarco is a fantasy name,’ Mr. Gonçalves said.” See “Prosecutor Cites Negligence in Brazil Dam Failure, as Aftereffects Grow,” *The Wall Street Journal*, November 10, 2015 (8:32 p.m. ET). A Vale spokeswoman stated that “Vale is only a mere shareholder in Samarco, without any operational interference in the management of this company, whether directly or indirectly, closely or remotely,” and that “Vale really doesn’t have any responsibility for the unfortunate and sad accident that occurred in Mariana, Minas Gerais.” See “Vale Says Samarco, Not Vale Responsible for Dam Burst in Brazil,” *Dow Jones Newswire*, November 11, 2015 and “Samarco May Not Shield BHP, Vale from Brazil Dam – Breach Repercussions,” *The Wall Street Journal*, November 11, 2015.

⁶⁵ Securities analysts in the following days also understood that it was important to get clarity from Vale whether they could be held liable. Securities analysts at Morgan Stanley, for example, noted that one of the main topics that needed an explanation during the November 16, 2015 conference call was whether Vale has directly received any charges for the accident thus far. See Carlos De Alba, et al., “Samarco Accident: Questions for Vale’s Conference Call” *Morgan Stanley*, November 15, 2015 (11:27 p.m. ET). Vale, however, did not clarify that they could be held liable, but instead reiterated that “Samarco had an independent management”, that “there were no resources shared between Vale and Samarco or BHP and Samarco, whatsoever”, and that Vale did not share systems or functions with Samarco. See Vale S.A. Conference Call Transcript, November 16, 2015. This view was reiterated by securities analysts following the call, with the Deutsche Bank securities analysts stating that “Samarco operates independently from its shareholders” and that “Samarco’s management has operated independently from shareholders (no sharing of resources, systems, support functions, crews, safety technicians) despite having operations nearby.” See Wilfredo Ortiz, et al., “Conference call on Samarco provides some color amidst the uncertainty,” *Deutsche Bank Securities Inc.*, November 16, 2015 (10:25 p.m. ET.) Securities analysts from Morgan Stanley similarly reiterated that “[t]here is no sharing of systems, management teams, support functions, operations, safety technicians, etc, between Vale and Samarco.” With respect to legal charges, Morgan Stanley reported that “[a]ccording to management, Samarco’s shareholders have no responsibility for administrative charges, so no impact is expected for Vale or BHP on this front,” that “[c]riminal charges would only be applicable to Vale if it is proved that the shareholders were responsible,” and that “[c]ivil and environmental charges would, at first, be [the] responsibility of Samarco, but it is still uncertain at this point.” See Carlos De Alba, et al., “Samarco Accident: What is Next? No. 2,” *Morgan Stanley*, November 16, 2015 (6:51 p.m. ET.)

and indirect polluter,⁶⁶ and (2) Vale's risk mitigation policies, plans, and procedures were inadequate, and to the extent those inadequacies contributed to the Fundão Dam collapse, that Vale could be held liable for the collapse.⁶⁷

ii. Friday, November 27, 2015

63. On Friday, November 27, 2015, after the market closed,⁶⁸ the *Wall Street Journal* announced that Brazil's government was preparing to sue Vale, BHP Billiton Ltd., and Samarco Mineração SA for BRL 20 billion (or approximately \$5.3 billion) in response to the Fundão Dam collapse that had occurred on November 5, 2015.⁶⁹ The size of the fund demanded by the Brazilian government dwarfed the initial estimates by Deutsche Bank that the clean-up

⁶⁶ In the following days, prosecutors noted that "there was evidence that Vale may have been dumping detritus from its own nearby iron-ore mines into Samarco's waste reservoir." Vale, however, did not respond to requests to comment on whether it had been using Samarco's dams. See "Prosecutor Cites Negligence in Brazil Dam Failure, as Aftereffects Grow," *The Wall Street Journal*, November 10, 2015 (8:32 p.m. ET). A Vale spokeswoman responded the next day, stating that "Vale is only a mere shareholder in Samarco, without any operational interference in the management of the company, whether directly or indirectly, closely or remotely" and that "Vale really doesn't have any responsibility for the unfortunate and sad accident that occurred in Mariana, Minas Gerais." See "Vale Says Samarco, Not Vale Responsible for Dam Burst in Brazil," *Dow Jones Newswire*, November 11, 2015 and "Samarco May Not Shield BHP, Vale from Brazil Dam – Breach Repercussions," *The Wall Street Journal*, November 11, 2015. Weeks later, after Vale belatedly admitted that it had been using the Dam to store its own wastes, prosecutors questioned "whether a contract that allowed Vale to dump waste from its nearby Algria iron-ore mine into the Samarco dam was properly licensed and monitored." *The Wall Street Journal* noted that "[t]he existence of the contract could raise questions about Vale's potential liability for the Nov. 5 accident" but that "[b]oth Vale and BHP Billiton have insisted that Samarco – as an independently run, limited liability company – was solely responsible for the tailings dams." See "Brazil Prosecutors Narrow Probe of Vale, BHP Billiton's Samarco Dam," *The Wall Street Journal*, November 24, 2015 (7:13 p.m. ET).

⁶⁷ The truth was subsequently revealed to the market. On Friday, after the market closed, the *Wall Street Journal* announced that the Brazilian government was preparing to sue Vale, BHP, and Samarco. On Monday, November 30, 2015, the Brazilian government filed a lawsuit against Vale, Samarco, and BHP for BRL 20 billion (or approximately \$5.2 billion), revealing that contrary to Vale's statements disclaiming any involvement or responsibility for the Fundão Dam collapse, Vale was likely responsible as a controlling shareholder and as a direct contributor of tailings to the Fundão Dam. On Friday, December 18, 2015, after the market closed, a Brazilian federal judge issued an order freezing Vale's Brazilian mining assets and finding Vale responsible for the harm the collapse had caused. See Complaint, ¶¶ 142-143 and "Brazil to Sue Vale, BHP Billiton Over Dam Collapse," *The Wall Street Journal*, November 27, 2015 (3:54 p.m. ET).

⁶⁸ The NYSE closed at 1:00 p.m. ET on Friday, November 27, 2015, the day after Thanksgiving.

⁶⁹ "Brazil to Sue Vale, BHP Billiton Over Dam Collapse," *The Wall Street Journal*, November 27, 2015 (3:54 p.m. ET). The civil suit was expected to be filed on Monday, November 30, 2015.

cost would be approximately \$1 billion.⁷⁰ The funds from the civil lawsuit were expected to pay for environmental recovery and to compensate victims.⁷¹ The Attorney General's office also commented that the amount of damages sought "is preliminary and could be raised over the judicial process, since the environmental damages of the mud's arrival at the ocean have not yet been calculated."⁷² The *Wall Street Journal* also remarked that "Vale and BHP Billiton have attempted to distance themselves legally from Samarco – a limited liability company they say is independently run – while touting their contributions to recovery efforts."⁷³

64. On Sunday, November 29, 2015, Morgan Stanley also issued an analyst report noting that while Samarco has already been fined BRL 250 million by Brazil's environmental agency (Ibama), it understood that there are likely additional penalties against Samarco on top of the BRL 20 billion the Brazilian government is seeking in the civil lawsuit.⁷⁴ The securities analysts at Morgan Stanley observed that the BRL 20 billion in damages would be particularly critical for Vale and that while it would prove difficult for Vale to walk away from Samarco, the decline in iron ore prices would make it challenging for Vale to cover its

⁷⁰ "Brazil to sue mining companies BHP and Vale for \$5bn over dam disaster," *The Guardian*, November 27, 2015 (9:09 p.m. ET). Deutsche Bank issued an analyst report on November 10, 2015, noting that its "initial estimate had been 3 years of lost production (now estimate 18-36 months) and up to a \$1bn bill (remains reasonable)." Wilfredo Ortiz, et al., "Samarco – attempting to put some context to financial impact," *Deutsche Bank Securities Inc.*, November 10, 2015 (10:25 p.m. ET.) Timestamp sourced from S&P Capital IQ.

⁷¹ "Brazil to sue mining companies BHP and Vale for \$5bn over dam disaster," *The Guardian*, November 27, 2015 (9:09 p.m. ET).

⁷² "Brazil to File \$5.3 Billion Suit Against Dam Owners," *The Wall Street Journal*, November 27, 2015 (7:13 p.m. ET).

⁷³ "Brazil to File \$5.3 Billion Suit Against Dam Owners," *The Wall Street Journal*, November 27, 2015 (7:13 p.m. ET).

⁷⁴ Carlos De Alba, et al., "Samarco Accident No. 3: Stakes Getting Higher," *Morgan Stanley*, November 29, 2015 (10:19 p.m. ET). Timestamp sourced from S&P Capital IQ.

share of the potential damages, noting the following:⁷⁵

On the one hand, the company [Vale] is a Brazilian entity with most of its operations in the country, so it would prove difficult to walk away from Samarco. However, on the other hand, at spot commodity prices we estimate Vale would generate negative FCF of ~ US\$2B in 2016-17 (even including ~US\$2.4B from Nacala's project financing), making it very challenging for the company to cover R\$10B in potential damages related to its share in Samarco. Keep in mind that Vale received dividends from the JV of US\$595M in 2013 (iron ore average US\$135), US\$401M in 2014 (IO US\$97) and US\$146M YTD in 2015 (IO US\$57). Our commodities team forecasts iron ore price will average US\$58/t over the next five years.

65. Furthermore, the securities analysts remarked that legal experts with whom Morgan Stanley had consulted believe that "it is possible for Samarco's shareholders to avoid any further responsibility based on the independent nature of Samarco's management and operation" but that these legal experts also mentioned that "every entity or person that finds themselves affected by the incident may bring Samarco, and its shareholders, before courts and that it is possible that judges rule that Vale and BHP have to answer for social and environment damages under a 'joint/subsidiary liability system'."⁷⁶ Securities analysts at Morgan Stanley also noted that a definitive resolution to the matter concerning the toxicity of the tailings from the dam burst would be critical in determining the extent of the potential damages, noting the following:⁷⁷

While Samarco, BHP, and Vale have repeatedly claimed that the tailings from the burst dam are chemically inert and contain only iron, alumina and silica, the UN Office of the High Commissioner for Human Rights said evidence showed the residues contained high levels of toxic heavy materials and other toxic chemicals. Further, the Institute for Water Management in Minas Gerais (IGAM) found arsenic levels more than ten times above the legal limit at seven places along the Doce river

⁷⁵ Carlos De Alba, et al., "Samarco Accident No. 3: Stakes Getting Higher," *Morgan Stanley*, November 29, 2015 (10:19 p.m. ET).

⁷⁶ Carlos De Alba, et al., "Samarco Accident No. 3: Stakes Getting Higher," *Morgan Stanley*, November 29, 2015 (10:19 p.m. ET).

⁷⁷ Carlos De Alba, et al., "Samarco Accident No. 3: Stakes Getting Higher," *Morgan Stanley*, November 29, 2015 (10:19 p.m. ET).

after the dam accident. We think a definitive resolution of this matter is critical to determine the extent of the potential damages that Samarco, and potentially its shareholders, may face.

66. The securities analysts at Morgan Stanley also noted that Samarco had missed its deadline to pay the first BRL 500 million tranche of the compensation fund.⁷⁸ The securities analysts explained, however, that the deadline was missed because Samarco had its accounts and funds frozen by a local court. Samarco had asked the authorities to extend the deadline to December 2 for the agreed-upon BRL 500 million deposit, to which the local court agreed, but the court charged Samarco an additional BRL 1.2 million fee.
67. In response to the revelation that Vale could be facing significantly higher exposure than what had previously been expected, the prices of the Vale Common ADRs and the Vale Preferred ADRs dropped 5.60 percent and 9.46 percent, respectively, on Monday, November 30, 2015, the first trading day after the civil lawsuit was announced. The respective daily abnormal returns were -5.09 percent and -8.63 percent for the Vale Common ADRs and the Vale Preferred ADRs, respectively. Both abnormal returns are statistically significant at the 5% level. (See **Exhibits 6** and **7**.)
68. I find that these statistically significant negative abnormal returns were substantially caused by the revelation that contrary to Vale's statements regarding its purported risk mitigation plans, policies, and procedures, its statements concerning the safety of Vale's operations and dams, and its statements disclaiming any involvement or responsibility for the Fundão Dam collapse, that Vale indeed could be held liable, and that the potential litigation exposure of \$5.2 billion (against Vale, Samarco, and BHP) is substantially larger than previously

⁷⁸ Carlos De Alba, et al., "Samarco Accident No. 3: Stakes Getting Higher," *Morgan Stanley*, November 29, 2015 (10:19 p.m. ET).

expected by market participants.⁷⁹

iii. Friday, December 18, 2015

69. On Friday, December 18, 2015, after the market closed, a Brazilian federal judge issued an order ruling that both Vale and BHP Billiton likely would be held responsible for the Fundão Dam collapse.⁸⁰ Over the weekend, the news coverage continued, with Reuters reporting that Vale's assets had been frozen following the issuance of the Brazilian court order to ensure that Vale could comply with its obligations. According to Reuters, "Vale had argued Samarco, as an independent legal entity and a sizeable company in its own right, was wholly responsible for the accident and the subsequent damages and fines."⁸¹ The federal judge, however, disagreed, and concluded that "Vale and BHP, as controllers of Samarco, can be classified as indirect polluters and as such responsible for the environmental damage caused."⁸² The judge also wrote in a preliminary ruling late Friday that Vale's agreement to dump its own tailings into the Fundão Dam "is sufficient to lay the foundation for the claim that Vale should be considered a direct polluter and, in this quality, responsible for the environmental damage."⁸³ The judge also imposed a number of requirements, among which that Samarco must make an initial deposit of BRL 2 billion within 30 days to cover the

⁷⁹ Deutsche Bank issued an analyst report on November 10, 2015, noting that its "initial estimate had been 3 years of lost production (now estimate 18-36 months) and up to a \$1bn bill (remains reasonable)." Wilfredo Ortiz, et al., "Samarco – attempting to put some context to financial impact," *Deutsche Bank Securities Inc.*, November 10, 2015 (10:25 p.m. ET.) Timestamp sourced from S&P Capital IQ.

⁸⁰ "Judge blocks Brazilian assets of Vale, BHP after dam burst," *Reuters News*, December 19, 2015 (12:39 p.m ET). The federal judge was identified as Marcelo Aguiar Machado. The judgement did not specify the value of the assets that had been blocked, but the prosecutor estimated that Samarco did not have sufficient funds to cover more than half of the BRL 20 billion being sought in damages.

⁸¹ "Judge blocks Brazilian assets of Vale, BHP after dam burst," *Reuters News*, December 19, 2015 (12:39 p.m ET).

⁸² "Judge blocks Brazilian assets of Vale, BHP after dam burst," *Reuters News*, December 19, 2015 (12:39 p.m ET).

⁸³ "Brazilian Judge Rules Vale Shares Responsibility for Catastrophic Dam Break," *The Wall Street Journal*, December 21, 2015 (10:56 p.m ET).

clean-up expenses.⁸⁴ The companies were also directed to provide an extensive clean-up plan and required to contract within 10 days for a company to evaluate the contamination of the fish caused by the mud slide and assess the possible risk to humans who might consume the fish.⁸⁵

70. According to the Complaint, the Brazilian court found that there was sufficient evidence to support a finding that Vale was responsible for the Fundão Dam collapse as a “direct polluter”.⁸⁶

The proof (public confession and technical report) make[s] it evident that Vale S/A is directly responsible for the damage, because it is also classified as a direct polluter, inasmuch as the tailings from its mining operations comprised the mass of mud and tailings that caused the environmental disaster.

71. The Brazilian court also found it likely that Vale’s control of Samarco made it responsible as an indirect polluter:⁸⁷

In this case, the companies Vale S/A and BHP Billiton Brasil Ltda, as controlling entities of Samarco Mineração S/A, are not only the beneficiaries of the mining activities carried out by Samarco, but also co-responsible for the decisions made by the controlled company.

72. According to the Complaint, the judge “also focused on Vale’s joint responsibility for the decisions made by the controlled company, finding that under Brazilian law, ‘the liability of both controllers to bear costs to remediate the damage would also come from the very fact that the company SAMARCO is [a] closed-capital stock company and it is under the

⁸⁴ “Judge blocks Brazilian assets of Vale, BHP after dam burst,” *Reuters News*, December 19, 2015 (12:39 p.m ET). The companies faced a BRL 1.5 million fine for each day the balance remained unpaid.

⁸⁵ “Judge blocks Brazilian assets of Vale, BHP after dam burst,” *Reuters News*, December 19, 2015 (12:39 p.m ET). The companies would face a fine of BRL 150,000 each day that they fail to meet the deadlines.

⁸⁶ Complaint, ¶ 86.

⁸⁷ Complaint, ¶ 86.

controller power of the companies VALE and BHP.”⁸⁸

73. Securities analysts at HSBC Securities also issued an analyst report on Tuesday, December 22, 2015, remarking that the “most controversial piece of this ruling has been the revocation of all mining licenses that Vale has in Brazil.”⁸⁹ The securities analysts estimated that without the licenses to mine, Vale would be able to work with iron ore in its stockyard for two weeks at the most before being impacted by the ruling.⁹⁰
74. In response to this revelation that Vale’s assets had been frozen and that the Brazilian federal court had found that Vale could be held responsible for the Fundão Dam collapse, the prices of the Vale Common ADRs and the Vale Preferred ADRs dropped 4.06 percent and 3.57 percent, respectively, on Monday, December 21, 2015, the first trading day after this information was disclosed to the market. The respective daily abnormal returns were -4.77 percent and -4.17 percent for the Vale Common ADRs and the Vale Preferred ADRs, respectively. Both abnormal returns are statistically significant at the 5% level. (*See Exhibits 6 and 7.*)
75. I find that these statistically significant negative abnormal returns were substantially caused by the revelation that, contrary to Vale’s statements regarding its purported risk mitigation plans, policies, and procedures, its statements concerning the safety of Vale’s operations and dams, and its statements disclaiming any involvement or responsibility for the Fundão Dam collapse, a Brazilian federal court had found that Vale was likely a direct and indirect polluter and could be held responsible for the Fundão Dam collapse, and this decision had

⁸⁸ Complaint, ¶ 143.

⁸⁹ Leonardo Shinohara, et al., “Buy: Vale’s quagmire: Samarco’s ability hits shareholders,” *HSBC Securities*, December 22, 2015 (12:00 p.m. ET). Timestamp sourced from S&P Capital IQ.

⁹⁰ Leonardo Shinohara, et al., “Buy: Vale’s quagmire: Samarco’s ability hits shareholders,” *HSBC Securities*, December 22, 2015 (12:00 p.m. ET).

resulted in the seizure of Vale's Brazilian mining assets to ensure that Vale could comply with its obligations to clean up the damage and compensate the victims.

C. Conclusions Based on the Loss Causation Analysis

76. I have drawn the following conclusions based on my loss causation analysis:

- a. The Vale ADRs declined in price during the Proposed Class Period when the truth regarding Vale's risk mitigation plans, policies, and procedures, and its responsibility for the Fundão Dam collapse were disclosed to the market on the Disclosure Dates, and the ADR price declines on November 30, 2015 and December 21, 2015 were statistically significant at the 5% level or better.
- b. The statistically significant price declines of the Vale Common ADRs and the Vale Preferred ADRs on November 30, 2015 and December 21, 2015 were substantially caused by the revelation of the truth regarding Vale's inadequate risk mitigation plans, policies, and procedures, and its statements concerning the safety of Vale's operations and dams, which culminated in a Brazilian federal court issuing an order finding Vale responsible for the harm the Fundão Dam collapse caused and freezing Vale's Brazilian mining assets to ensure that Vale could comply with its obligations to clean up the damage and compensate the victims.
- c. The statistically significant abnormal returns on November 30, 2015 and December 21, 2015 were not due to any market-wide factors, industry-specific factors, or non-fraud-related Vale news, but were substantially caused by the revelation of the facts that corrected Vale's false and misleading statements and omissions regarding its risk mitigation plans, policies, and procedures, the safety of Vale's operations and dams, and Vale's responsibility for the Fundão Dam collapse.

VII. Calculation of Damages to Vale Common ADR and Vale Preferred ADR Holders

77. Counsel has also asked me to opine as to whether damages per Vale ADR could be calculated on a class-wide basis for the members of the Proposed Class who purchased Vale Common ADRs or Vale Preferred ADRs during the Proposed Class Period and suffered damages when the fraud-related inflation was removed from the prices of the Vale ADRs. Assuming Plaintiffs prove liability, it is my opinion that the damages per ADR can be calculated on a class-wide basis.
78. Every Proposed Class member's damages per ADR can be directly calculated utilizing the same methodology, which is therefore common to all the Proposed Class members. This class-wide damages methodology, which is described in the following paragraphs, is in accordance with widely used and generally accepted damages methodologies applied in securities fraud class action matters and, to my understanding, is also in accord with the relevant statutes.

A. Methodology for Calculating Damages per ADR during the Proposed Class Period

79. Damages per ADR are calculated based on the difference between the actual ADR prices during the damage period and the ADR prices that would have prevailed had the alleged fraud not occurred (the "but-for price line" or the "value line") and the number of shares exposed to the alleged fraud. The critical component of the damage calculation is therefore the amount of "inflation" in the prices of the Vale ADRs on each day that is directly attributable to the alleged fraud.
80. Information released into the market on the corrective Disclosure Dates corrected for the allegedly false and misleading statements and omissions made during the Proposed Class Period. My damages calculation was performed based on the loss causation analysis presented in the previous section of this expert report. I calculated the amount of price

inflation in the Vale Common ADRs and the amount of price inflation in the Vale Preferred ADRs during the Proposed Class Period, which extends from May 8, 2014 through November 27, 2015, inclusive. I also measured the effect of the revelation of the alleged fraud on the November 30, 2015 and December 21, 2015 Disclosure Dates based on the but-for price line I determined.

81. In order to determine the amount of inflation in the prices of the Vale Common ADRs and the Vale Preferred ADRs during the Proposed Class Period, I adjusted the damages per ADR calculation to remove the effects of market-wide factors, industry-wide factors, and any potentially Vale-specific confounding news, that is, Vale-specific announcements of economically significant information that is unrelated to the alleged fraud. The but-for price line controls for all these factors.
82. Between adjacent corrective Disclosure Dates as well as the days prior to the first Disclosure Date, I assumed that the amount of inflation per ADR is a constant dollar amount. This method of damage calculation, which is often referred to as the constant dollar method, implies that there are no damages when shares are purchased and sold before the fraud is revealed, and by implication for the case of multiple disclosure dates, when the shares are purchased and sold between adjacent corrective Disclosure Dates. This method of calculation is consistent with the Supreme Court's decision on loss causation in Dura.⁹¹
83. The 90-day "look-back" provision of the Private Securities Litigation Reform Act of 1995 (the "PSLRA")⁹² caps the amount of per-share damages when a firm's stock price rebounds within 90 days following the end of the Proposed Class Period. This cap can be also be

⁹¹ *Dura Pharm. v. Broudo*, 544 U.S. 336, 342 (2005).

⁹² Private Securities Litigation Reform Act of 1995, Pub. L. No. 104-67, 202 Stat. 737 (1995).

applied on a per-ADR basis to all Proposed Class members who sold on a given date during the “look-back” period. Specifically, when the ADRs are sold within 90 days of the end of the Proposed Class Period, the PSLRA damages cap equals the difference between the price paid for the ADRs and the average ADR price during the period that begins on the last day of the Proposed Class Period and ends on the date of sale. When the shares are sold 90 days or more beyond the last day of the Proposed Class Period, the cap equals the difference between the price paid and the average price during the 90 days beginning on the last day of the Proposed Class Period.

B. Calculation of Damages per ADR during the Proposed Class Period

84. I first calculated the amount of inflation dissipation per share on each of the corrective Disclosure Dates. One must adjust the damages per share calculation to remove the effects of market-wide factors, industry-wide factors, and any confounding news, that is, economically significant Vale-specific information that is unrelated to the alleged fraud. The abnormal returns net of all market-wide, industry-wide, and Vale-specific effects unrelated to the alleged fraud, which were discussed in the previous section of this expert report, represent the amount of damages per ADR attributable to the disclosure of the alleged fraud on each of the corrective Disclosure Dates. My damages calculations for the corrective Disclosure Dates are based on the loss causation analysis presented in the previous section of this expert report. (See **Exhibits 6 and 7.**) Based on my review of the news articles and analyst reports on the corrective Disclosure Dates, I did not find any potentially confounding Vale-related news that is unrelated to the alleged fraud. I therefore attribute 100% of the abnormal returns on the corrective Disclosure Dates to the alleged fraud.
85. Furthermore, based on my review of the allegedly false and misleading statements and omissions concerning Vale’s mitigation plans, policies, and procedures, and its statements

concerning the safety of Vale's operations and dams in the 2013 Sustainability Report that was referenced in Vale's Form 6-K filing on May 8, 2014, and the statements from Vale disclaiming responsibility for the Fundão Dam collapse during its conference call on November 16, 2015, I find that these misrepresentations and omissions are of such a nature that they *prevented* an otherwise expected price decrease had the material negative information been disclosed to the market. Had it been disclosed to investors that Vale did not have adequate mitigation plans, policies, and procedures in place, that its statements concerning the safety of Vale's operations and dams were false and misleading, and that Vale was likely responsible for the Fundão Dam collapse, in part, based on these inadequacies, it is my opinion that this material information would have elicited a statistically significant negative price reaction for the Vale ADRs had this information been revealed to investors. Therefore, it is my opinion that the amount of inflation, as measured by the amount that dissipated on the corrective Disclosure Dates, would have persisted as of the beginning of the Proposed Class Period.

86. The dollar amount of inflation dissipation per Vale Common ADR and per Vale Preferred ADR on each corrective Disclosure Dates is calculated by multiplying the percentage abnormal return attributable to the fraud (that is, after adjusting for any company-specific information unrelated to the alleged fraud) on the day of each corrective disclosure by the closing ADR price on the day prior to the corrective Disclosure Date. (See **Exhibit 8**.) To be conservative, I only include the corrective Disclosure Dates that have statistically significant abnormal returns at the 5% level in my measure of economic loss.⁹³

⁹³ Of the three corrective Disclosure Dates, the abnormal returns for the Vale ADRs were not statistically significant at the 5% level on November 6, 2015. I have therefore excluded any amount of inflation dissipation on this date from my damages calculation, which is conservative in favor of Defendants for the reason set forth earlier in this expert report.

87. Based on my loss causation analyses discussed earlier in this report, I find that artificial inflation of \$0.18 per Vale Common ADR and \$0.26 per Vale Preferred ADR dissipated after the corrective disclosure on Friday, November 27, 2015, when it was revealed that Vale could be held liable for the Fundão Dam collapse and that its exposure was significantly greater than what market participants had initially estimated. (See **Exhibit 8**.)
88. I also found that artificial inflation of \$0.15 per Vale Common ADR and \$0.11 per Vale Preferred ADR dissipated after the corrective disclosure on Friday, December 18, 2015, when a Brazilian federal court ruled that Vale was likely a direct and indirect polluter and that Vale could be held responsible for the Fundão Dam collapse, which resulted in the seizure of Vale's Brazilian mining assets to ensure that Vale could comply with its obligations to clean up the damage and compensate the victims. (See **Exhibit 8**.)
89. The timing of when the Vale ADRs were purchased and sold is relevant in determining which cohort of investors is damaged by the alleged fraud. **Exhibit 9** sets forth the amount of inflation per Vale Common ADR, and **Exhibit 10** sets forth the amount of inflation per Vale Preferred ADR during the Proposed Class Period. Given the amount of inflation that dissipated on the two partial corrective Disclosure Dates with statistically significant abnormal returns, the following two cohorts of investors are eligible for damages during the Proposed Class Period.⁹⁴

Vale Common ADRs

- Case 1: Shareholders who bought Vale Common ADRs between May 8, 2014 and November 27, 2015 and retained the Vale Common ADRs to December 21, 2015.

⁹⁴ Shareholders who bought Vale ADRs between November 30, 2015 and December 18, 2015 and who sold the Vale ADRs after December 21, 2015 are also economically harmed. However, because they purchased their Vale ADRs after the end of the Proposed Class Period, these shareholders would not be part of the class.

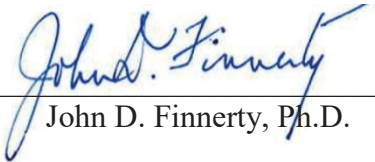
The maximum damages per ADR are \$0.33.⁹⁵ (See **Exhibit 9**.)

- Case 2: Shareholders who bought Vale Common ADRs between May 8, 2014 and November 27, 2015 and sold the Vale Common ADRs between November 30, 2015 and December 21, 2015. The maximum damages per ADR are \$0.18.⁹⁶ (See **Exhibit 9**.)

Vale Preferred ADRs

- Case 1: Shareholders who bought Vale Preferred ADRs between May 8, 2014 and November 27, 2015 and retained the Vale Preferred ADRs to December 21, 2015. The maximum damages per ADR are \$0.37.⁹⁷ (See **Exhibit 10**.)
- Case 2: Shareholders who bought Vale Preferred ADRs between May 8, 2014 and November 27, 2015 and sold the Vale Preferred ADRs between November 30, 2015 and December 21, 2015. The maximum damages per ADR are \$0.26.⁹⁸ (See **Exhibit 10**.)

Executed: July 19, 2019


John D. Finnerty, Ph.D.

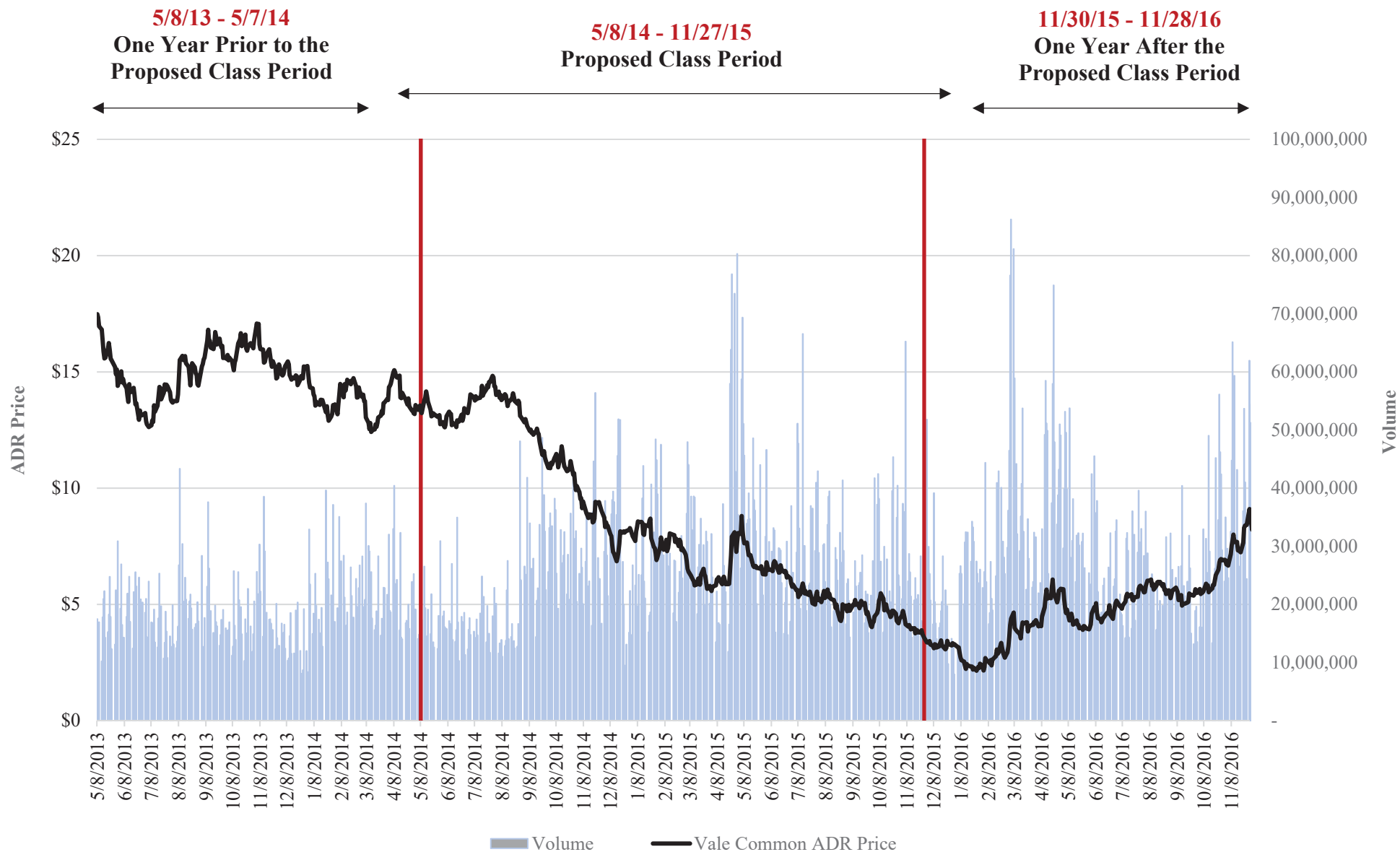
⁹⁵ Damages per Vale Common ADR equal to the sum of \$0.18 (the inflation per Vale Common ADR that dissipated after the November 27, 2015 disclosure) and \$0.15 (the inflation per Vale Common ADR that dissipated after the December 18, 2015 disclosure).

⁹⁶ Damages per ADR equal to \$0.18 (the inflation per ADR that dissipated after the November 27, 2015 disclosure).

⁹⁷ Damages per Vale Preferred ADR equal to the sum of \$0.26 (the inflation per Vale Preferred ADR that dissipated after the November 27, 2015 disclosure) and \$0.11 (the inflation per Vale Preferred ADR that dissipated after the December 18, 2015 disclosure).

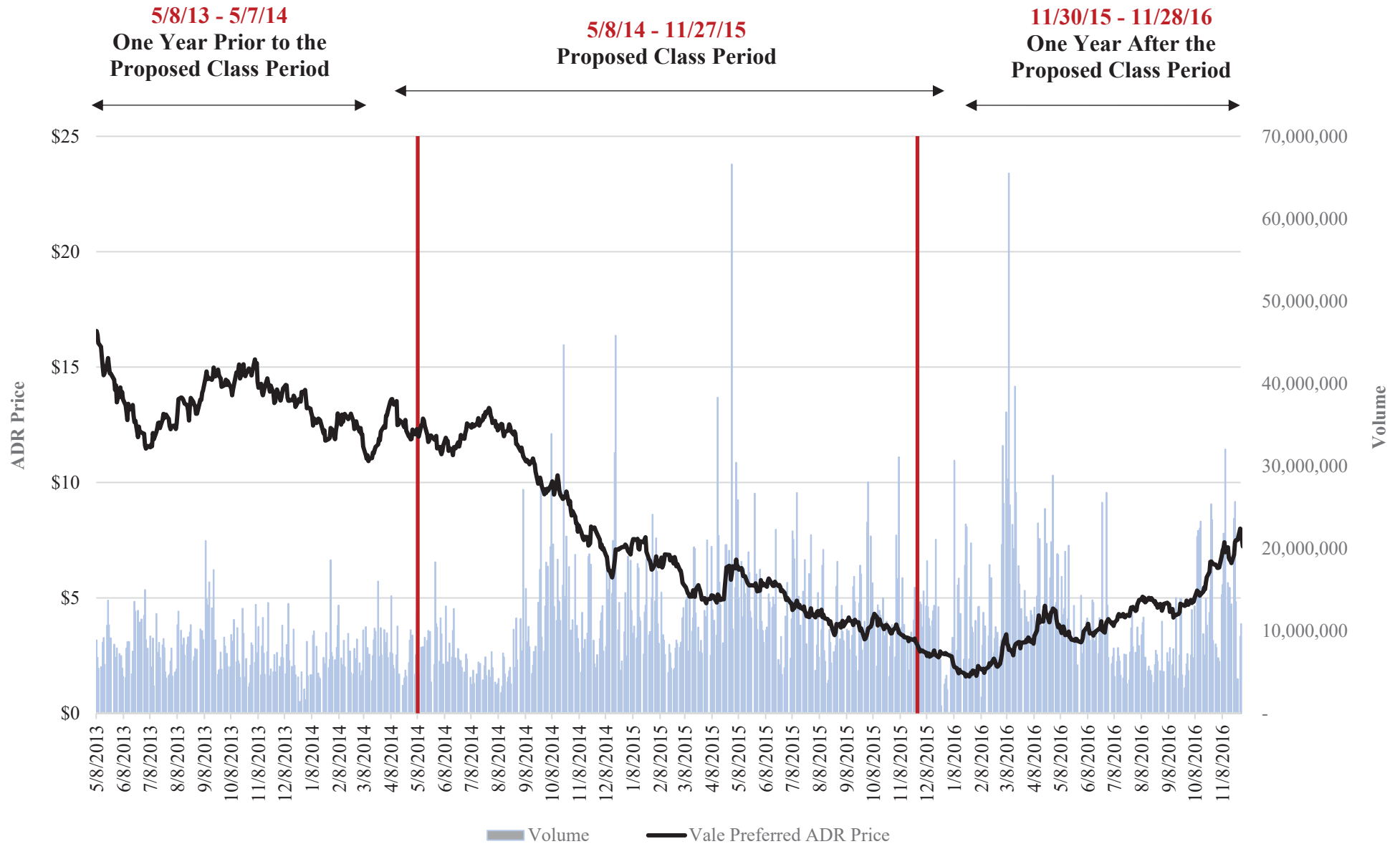
⁹⁸ Damages per Vale Preferred ADR equal to \$0.26 (the inflation per Vale Preferred ADR that dissipated after the November 27, 2015 disclosure).

Exhibit 1
In re: Vale S.A. Securities Litigation
Daily Price and Volume Movement for
Vale Common ADRs



Source: Bloomberg L.P.

Exhibit 2
In re: Vale S.A. Securities Litigation
Daily Price and Volume Movement for
Vale Preferred ADRs



Source: Bloomberg L.P.

Exhibit 3

In re: Vale S.A. Securities Litigation
Allegedly False and Misleading Statements and/or Omissions and Corrective Disclosure Dates
During the Proposed Class Period

Date	Time of Release (ET)	Effective Trading Date	Form of Release	Alleged		Event
				Misrep	Disclosure	
5/8/14	1:51 PM ^[1]	5/8/14	Form 6-K	✓		Vale's 2013 Sustainability Report was referenced in a press release that was filed with the SEC on Form 6-K. According to the Complaint, the 2013 Sustainability Report contained false and misleading statements and omissions concerning Vale's risk mitigation plans, policies, and procedures.
11/6/15	During ^[2] Market Hours	11/6/15	News and Analysts		✓	Securities analysts and news outlets commented on the Fundão Dam collapse that occurred on November 5th.
11/16/15	12:00 AM ^[3]	11/6/15	Conference Call	✓		Vale held a conference call with analysts and investors to discuss the tragic collapse of the Fundão Dam. According to the Complaint, Vale disclaimed all responsibility for the collapse and resulting damage by claiming that Samarco was a separate company with separate management, and suggested that Vale played no role in Samarco's management because "international competition regulations" prohibited Vale from "interfering" in Samarco's management. Vale also represented that Vale and Samarco did not "share systems, resources, or support functions."
11/27/15	3:54 PM ^[4] (After-Market)	11/30/15	Civil Lawsuit		✓	Brazilian prosecutors announced that they were going to sue Vale, BHP, and Samarco for BRL 20 billion (or approximately \$5.2 billion) to pay for the environmental damage they had caused and to compensate victims of the tragedy.
12/18/15	After- ^[5] Market	12/21/15	Court Order		✓	A Brazilian court ordered Vale (along with BHP and Samarco) to fund a comprehensive recovery plan to remediate the environmental and societal harm the Fundão Dam collapse caused. It also froze Vale's Brazilian mining assets to ensure that it complied with its obligations. In doing so, the Brazilian court found Vale likely responsible as both a "direct polluter" and as an "indirect polluter" through its control of Samarco.

Notes:

^[1] Vale S.A. Form 6-K, filed May 8, 2014. Timing of release based on SEC Edgar.

^[2] Various analyst reports and news outlets reported on the Fundão Dam collapse throughout the trading day. For example, an HSBC analyst report commented that the collapse would "hurt Vale's results" and would negatively impact pellet production and the likelihood that Vale would continue to receive dividends. According to S&P Capital IQ, the HSBC analyst report was released at 12:00 AM.

^[3] According to S&P Capital IQ, the conference call occurred at 12:00 pm ET.

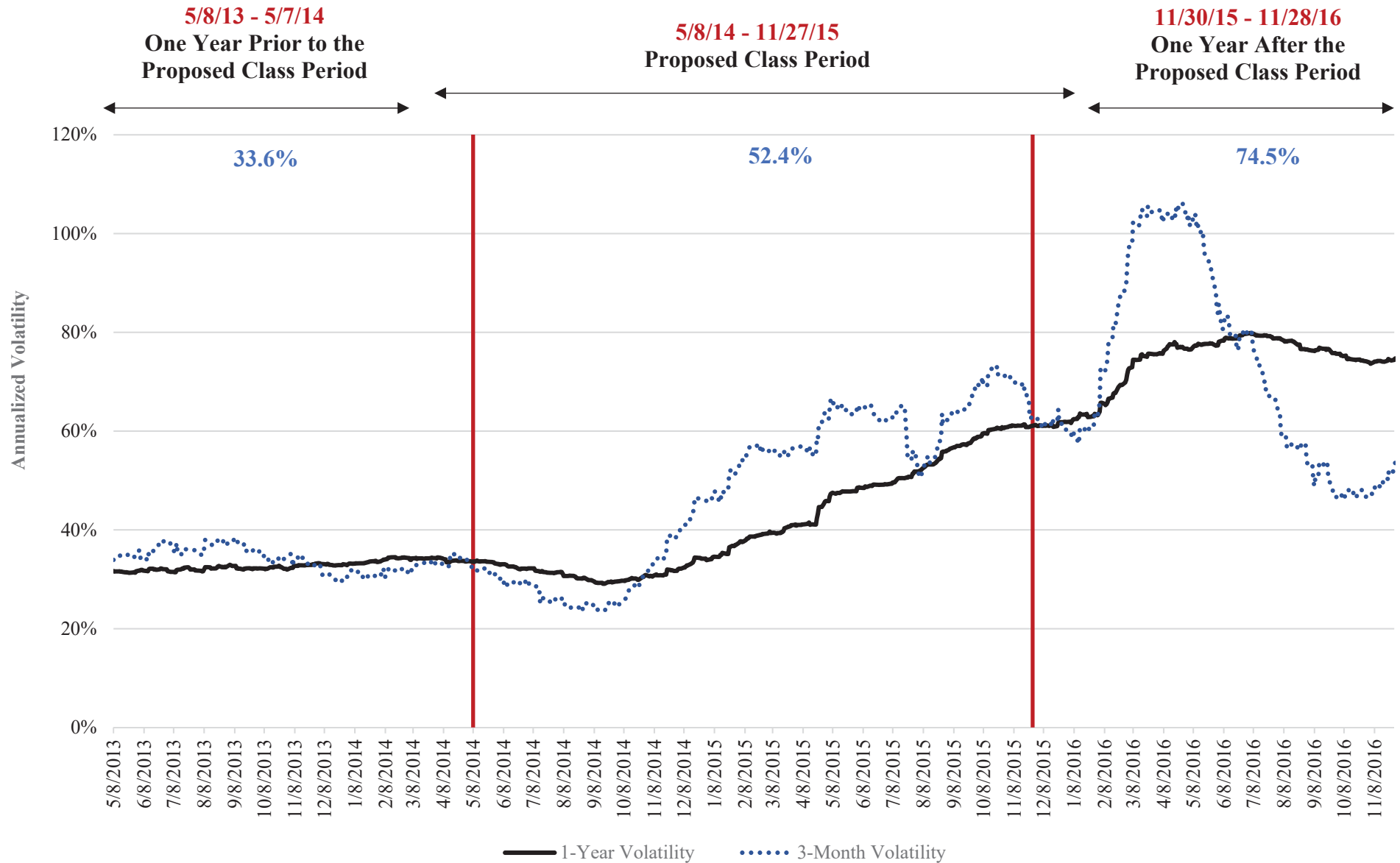
^[4] The NYSE was open until 1:00 pm ET, on the day following Thanksgiving, Friday, November 27, 2015.

^[5] The exact timing of the court order was not reported, but news articles suggest that the ruling was issued late on Friday, after the market had closed.

Sources:

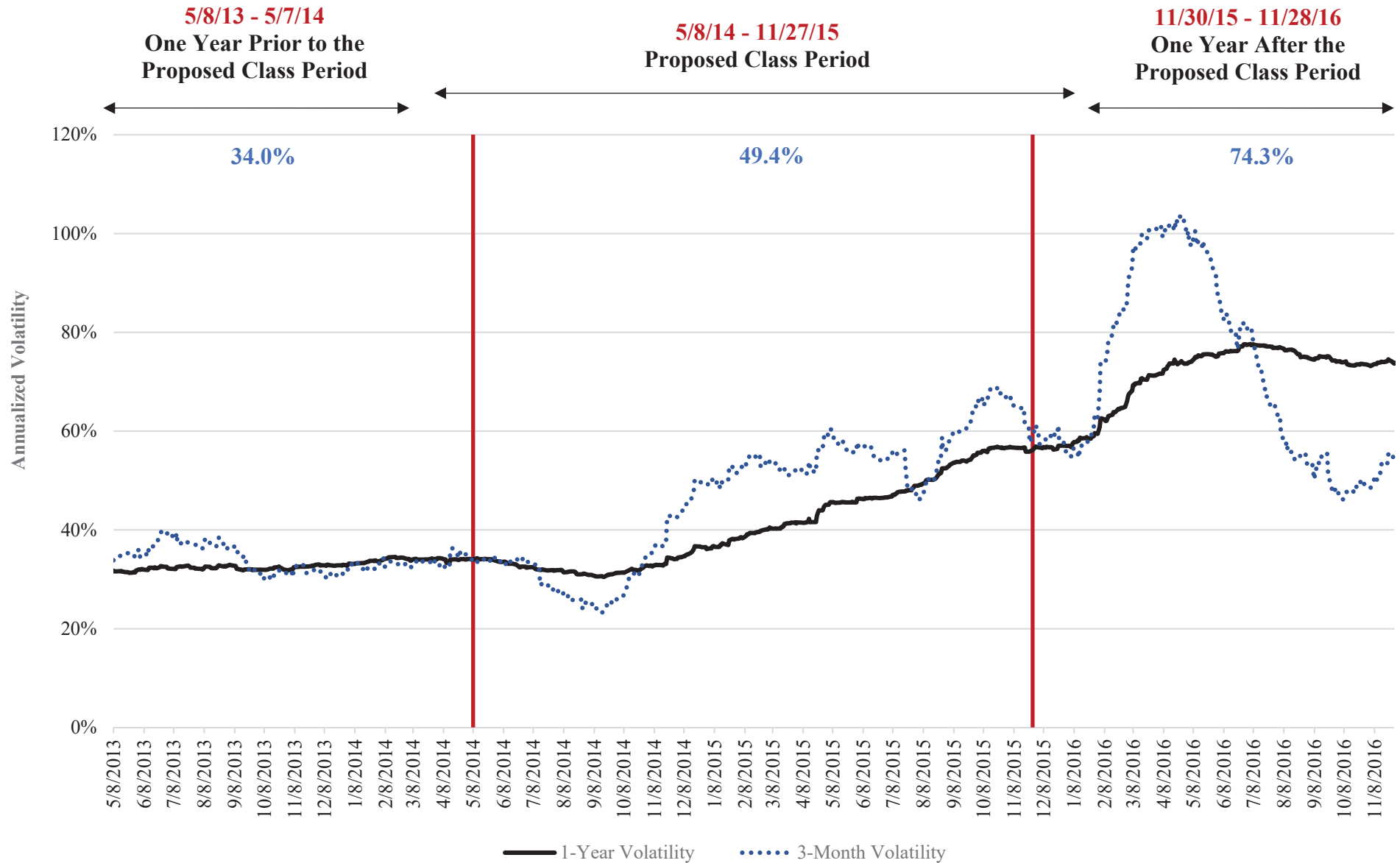
Bloomberg L.P.; Consolidated Amended Class Action Complaint, April 29, 2016; SEC Edgar; S&P Capital IQ; Wall Street Journal.

Exhibit 4
In re: Vale S.A. Securities Litigation
Trailing Annualized Vale Common ADR Volatility



Source: Bloomberg L.P.

Exhibit 5
In re: Vale S.A. Securities Litigation
Trailing Annualized Vale Preferred ADR Volatility



Source: Bloomberg L.P.

In re: Vale S.A. Securities Litigation

Calculation of Abnormal Returns Using the Modified Fama-French Three-Factor Model Including
(1) the S&P Metals and Mining Select Industry Total Return Index,
(2) the Bovespa Market Index, and
(3) the Daily Return of Brazilian Real in \$USD

Vale Common ADRs

Estimation Period: May 8, 2014 through November 27, 2015 (Proposed Class Period) ^[1]

Panel A. Fitting the Modified Fama-French Three-Factor Model ^[2]

Regression: $R_{VALE,COM}-R_F = \beta_0 + \beta_1(Mkt-R_F) + \beta_2(SMB) + \beta_3(HML) + \beta_4(\text{S\&P Metals \& Mining Select Industry Total Return Index}) + \beta_5(\text{Bovespa}) + \beta_6(\text{Exchange Rate})$

SubPeriod 1: 5/8/2013 - 5/11/2015

	Coeff.	StdErr	t-stat	p-value		
β_0	0.0001	0.0015	0.0489	0.9610	R-squared	45.09%
β_1	-0.7632	0.2770	-2.7547	0.0063	Adjusted R-squared	43.66%
β_2	-1.1172	0.3373	-3.3124	0.0011	S.E. of regression	2.22%
β_3	0.0798	0.4932	0.1619	0.8716	Sum squared resid	0.1126
β_4	0.9439	0.1262	7.4783	0.0000	Log likelihood	567.5691
β_5	0.4555	0.0943	4.8309	0.0000	F-statistic	31.3463
β_6	0.5769	0.1536	3.7564	0.0002		

SubPeriod 2: 5/12/2015 - 11/27/2015

	Coeff.	StdErr	t-stat	p-value		
β_0	0.0010	0.0020	0.4797	0.6323	R-squared	65.40%
β_1	-0.1182	0.3014	-0.3920	0.6958	Adjusted R-squared	63.69%
β_2	-1.2075	0.4367	-2.7651	0.0066	S.E. of regression	2.29%
β_3	-0.6904	0.4595	-1.5026	0.1355	Sum squared resid	0.0634
β_4	1.1116	0.1171	9.4932	0.0000	Log likelihood	305.4740
β_5	0.7670	0.2018	3.8011	0.0002	F-statistic	38.1243
β_6	-0.0213	0.1808	-0.1180	0.9063		

Panel B. Calculation of the Abnormal Return(s) on Select Date(s)

Date	R _F	Mkt-R _F	SMB	HML	Industry	Bovespa	BRL in USD	Predicted Return	Actual Return	Abnormal Return	t-stat	p-value	Sig
Remaining Misrepresentations and/or Omissions in the Amended Complaint													
5/8/14	0.00%	-0.26%	-1.00%	0.34%	-1.11%	-1.12%	0.13%	-0.13%	-1.33%	-1.19%	-0.539	0.591	
11/16/15	0.00%	1.39%	-0.58%	0.46%	1.37%	0.84%	0.69%	2.46%	0.25%	-2.21%	-0.967	0.336	
Remaining Partial Corrective Disclosures in the Amended Complaint													
11/6/15	0.00%	0.14%	0.81%	0.27%	-0.87%	-2.09%	0.23%	-3.66%	-5.69%	-2.04%	-0.891	0.375	
11/30/15	0.00%	-0.47%	0.14%	0.69%	0.96%	-1.44%	-0.58%	-0.51%	-5.60%	-5.09%	-2.225	0.028	**
12/21/15	0.00%	0.74%	-0.18%	-0.06%	1.22%	-1.21%	-0.76%	0.71%	-4.06%	-4.77%	-2.086	0.039	**

Notes:

^[1] Regression excluding two misrepresentation and/or omission dates (5/8/14, 11/16/15), and two partial corrective disclosure dates (11/6/15, 11/30/15).

On Friday, November 27, 2015, after the market closed, the Brazilian government stated its intent to file suit against Vale, BHP, and Samarco for \$5.2 billion. The stock price impact was reflected the following trading day on November 30, 2015.

^[2] Modified Fama-French Three-Factor model was run with the White heteroskedasticity adjustment for heteroskedasticity-adjusted standard errors.

The S&P Metals & Mining Select Industry Index (SPSIMMTR Index) is managed by S&P Dow Jones Indices LLC and is a modified equal-weighted index that is designed to measure the performance of stocks in the S&P Total Market Index that both (i) are classified under the Global Industry Classification Standard (GICS) in the aluminum, coal & consumable fuels, copper, diversified metals & mining, gold, precious metals & minerals, silver or steel sub-industries and (ii) satisfy one of the float-adjusted market capitalization (FAMC) and float-adjusted liquidity ratio (FALR) requirements.

Bovespa Index (IBOV Index) is adjusted to exclude Vale S.A. common and preferred stocks from the index, and represents the gross total return index weighted by free float market cap comprised of the most liquid stocks traded on the Sao Paulo Stock Exchange.

Exchange Rate is the daily return of Brazilian Real in \$USD.

***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Source: Bloomberg L.P.

In re: Vale S.A. Securities Litigation

Calculation of Abnormal Returns Using the Modified Fama-French Three-Factor Model Including
(1) the S&P Metals and Mining Select Industry Total Return Index,
(2) the Bovespa Market Index, and
(3) the Daily Return of Brazilian Real in \$USD

Vale Preferred ADRs

Estimation Period: **May 8, 2014 through November 27, 2015 (Proposed Class Period)** ^[1]

Panel A. Fitting the Modified Fama-French Three-Factor Model ^[2]

Regression: $R_{VALE, PFD} - R_F = \beta_0 + \beta_1(Mkt - R_F) + \beta_2(SMB) + \beta_3(HML) + \beta_4(\text{S\&P Metals \& Mining Select Industry Total Return Index}) + \beta_5(\text{Bovespa}) + \beta_6(\text{Exchange Rate})$

SubPeriod 1: 5/8/2013 - 5/11/2015

	Coeff.	StdErr	t-stat	p-value		
β_0	-0.0005	0.0014	-0.3424	0.7324	R-squared	44.83%
β_1	-0.6729	0.2477	-2.7165	0.0071	Adjusted R-squared	43.39%
β_2	-0.7640	0.3294	-2.3192	0.0213	S.E. of regression	2.10%
β_3	0.1215	0.4353	0.2790	0.7805	Sum squared resid	0.1012
β_4	0.8151	0.1288	6.3278	0.0000	Log likelihood	580.2151
β_5	0.4441	0.0998	4.4503	0.0000	F-statistic	31.0159
β_6	0.6611	0.1484	4.4552	0.0000		

SubPeriod 2: 5/12/2015 - 11/27/2015

	Coeff.	StdErr	t-stat	p-value		
β_0	0.0003	0.0019	0.1343	0.8934	R-squared	66.20%
β_1	-0.0633	0.2948	-0.2148	0.8303	Adjusted R-squared	64.53%
β_2	-1.3144	0.3771	-3.4858	0.0007	S.E. of regression	2.10%
β_3	-0.9515	0.3831	-2.4839	0.0144	Sum squared resid	0.0533
β_4	0.9987	0.1034	9.6578	0.0000	Log likelihood	316.5843
β_5	0.6379	0.1802	3.5401	0.0006	F-statistic	39.5024
β_6	0.1605	0.1696	0.9465	0.3458		

Panel B. Calculation of the Abnormal Return(s) on Select Date(s)

Date	R _F	Mkt-R _F	SMB	HML	Industry	Bovespa	BRL in USD	Predicted Return	Actual Return	Abnormal Return	t-stat	p-value	Sig
Remaining Misrepresentations and/or Omissions in the Amended Complaint													
5/8/14	0.00%	-0.26%	-1.00%	0.34%	-1.11%	-1.12%	0.13%	-0.39%	-1.54%	-1.16%	-0.551	0.582	
11/16/15	0.00%	1.39%	-0.58%	0.46%	1.37%	0.84%	0.69%	2.27%	-0.61%	-2.88%	-1.372	0.173	
Remaining Partial Corrective Disclosures in the Amended Complaint													
11/6/15	0.00%	0.14%	0.81%	0.27%	-0.87%	-2.09%	0.23%	-3.47%	-4.12%	-0.65%	-0.311	0.757	
11/30/15	0.00%	-0.47%	0.14%	0.69%	0.96%	-1.44%	-0.58%	-0.83%	-9.46%	-8.63%	-4.112	0.000	***
12/21/15	0.00%	0.74%	-0.18%	-0.06%	1.22%	-1.21%	-0.76%	0.60%	-3.57%	-4.17%	-1.986	0.049	**

Notes:

^[1] Regression excluding two misrepresentation and/or omission dates (5/8/14, 11/16/15), and two partial corrective disclosure dates (11/6/15, 11/30/15).

On Friday, November 27, 2015, after the market closed, the Brazilian government stated its intent to file suit against Vale, BHP, and Samarco for \$5.2 billion. The stock price impact was reflected the following trading day on November 30, 2015.

^[2] Modified Fama-French Three-Factor model was run with the White heteroskedasticity adjustment for heteroskedasticity-adjusted standard errors.

The S&P Metals & Mining Select Industry Index (SPSIMMTR Index) is managed by S&P Dow Jones Indices LLC and is a modified equal-weighted index that is designed to measure the performance of stocks in the S&P Total Market Index that both (i) are classified under the Global Industry Classification Standard (GICS) in the aluminum, coal & consumable fuels, copper, diversified metals & mining, gold, precious metals & minerals, silver or steel sub-industries and (ii) satisfy one of the float-adjusted market capitalization (FAMC) and float-adjusted liquidity ratio (FALR) requirements.

Bovespa Index (IBOV Index) is adjusted to exclude Vale S.A. common and preferred stocks from the index, and represents the gross total return index weighted by free float market cap comprised of the most liquid stocks traded on the Sao Paulo Stock Exchange.

Exchange Rate is the daily return of Brazilian Real in \$USD.

***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Source: Bloomberg L.P.

Exhibit 8

In re: Vale S.A. Securities Litigation
Inflation Dissipation on the Partial Corrective Disclosure Dates

Panel A. Inflation Dissipation on November 30, 2015

Date	Vale Common ADR			Vale Preferred ADR		
	Closing Price	Abnormal Return	Inflation Dissipation ^[1]	Closing Price	Abnormal Return	Inflation Dissipation ^[1]
11/27/15	\$ 3.57			\$ 2.96		
11/30/15	3.37	-5.09%	\$ 0.18	2.68	-8.63%	\$ 0.26

Panel B. Inflation Dissipation on December 21, 2015

Date	Vale Common ADR			Vale Preferred ADR		
	Closing Price	Abnormal Return	Inflation Dissipation ^[1]	Closing Price	Abnormal Return	Inflation Dissipation ^[1]
12/18/15	\$ 3.20			\$ 2.52		
12/21/15	3.07	-4.77%	\$ 0.15	2.43	-4.17%	\$ 0.11

Note:

^[1] Inflation Dissipation = -Abnormal Return (%) × Prior Trading Day Closing Price. Amounts rounded to the nearest penny.

Exhibit 9
In re: Vale S.A. Securities Litigation
Inflation Ribbon During the Proposed Class Period between
May 8, 2014 and November 27, 2015 for Vale Common ADRs

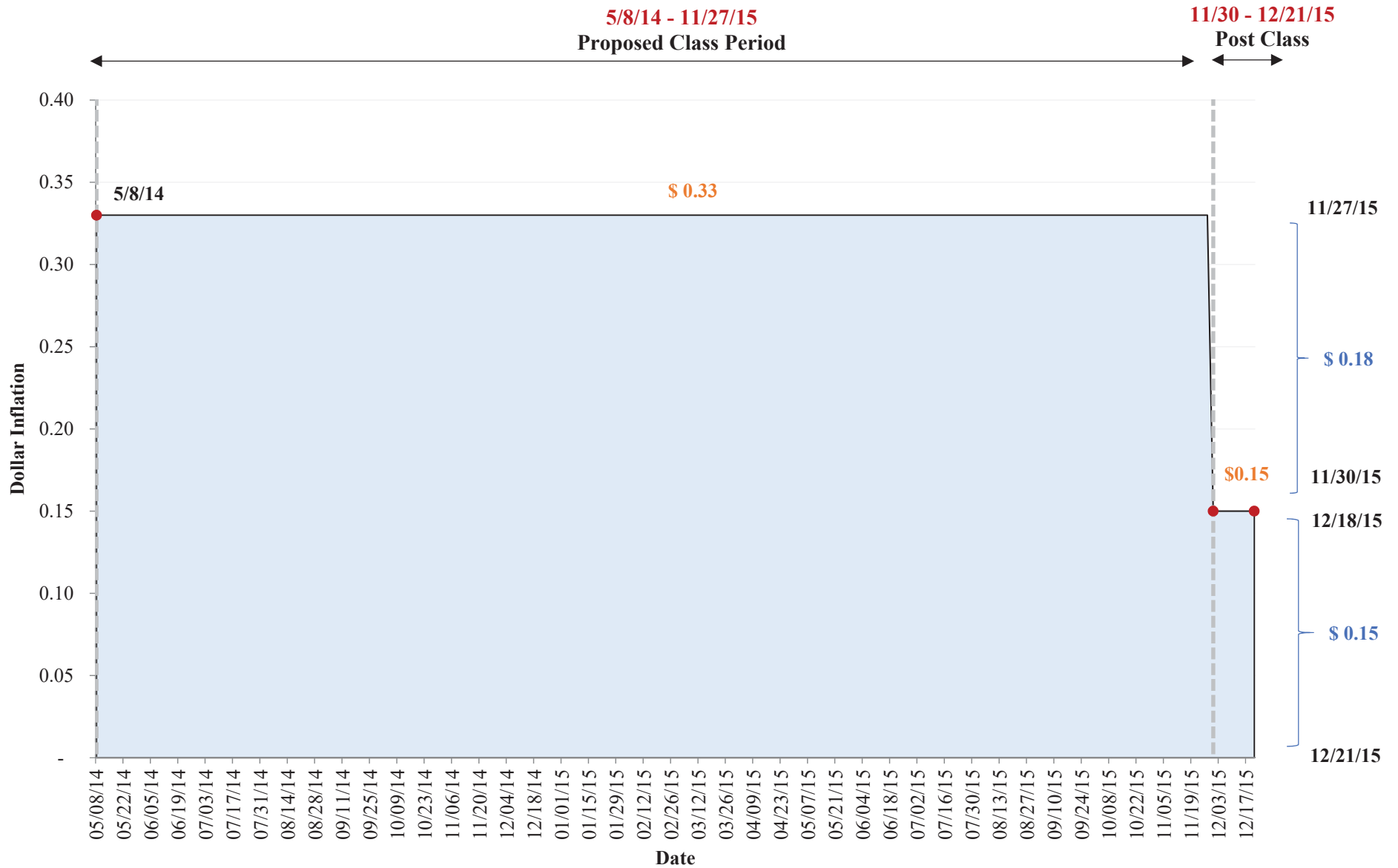
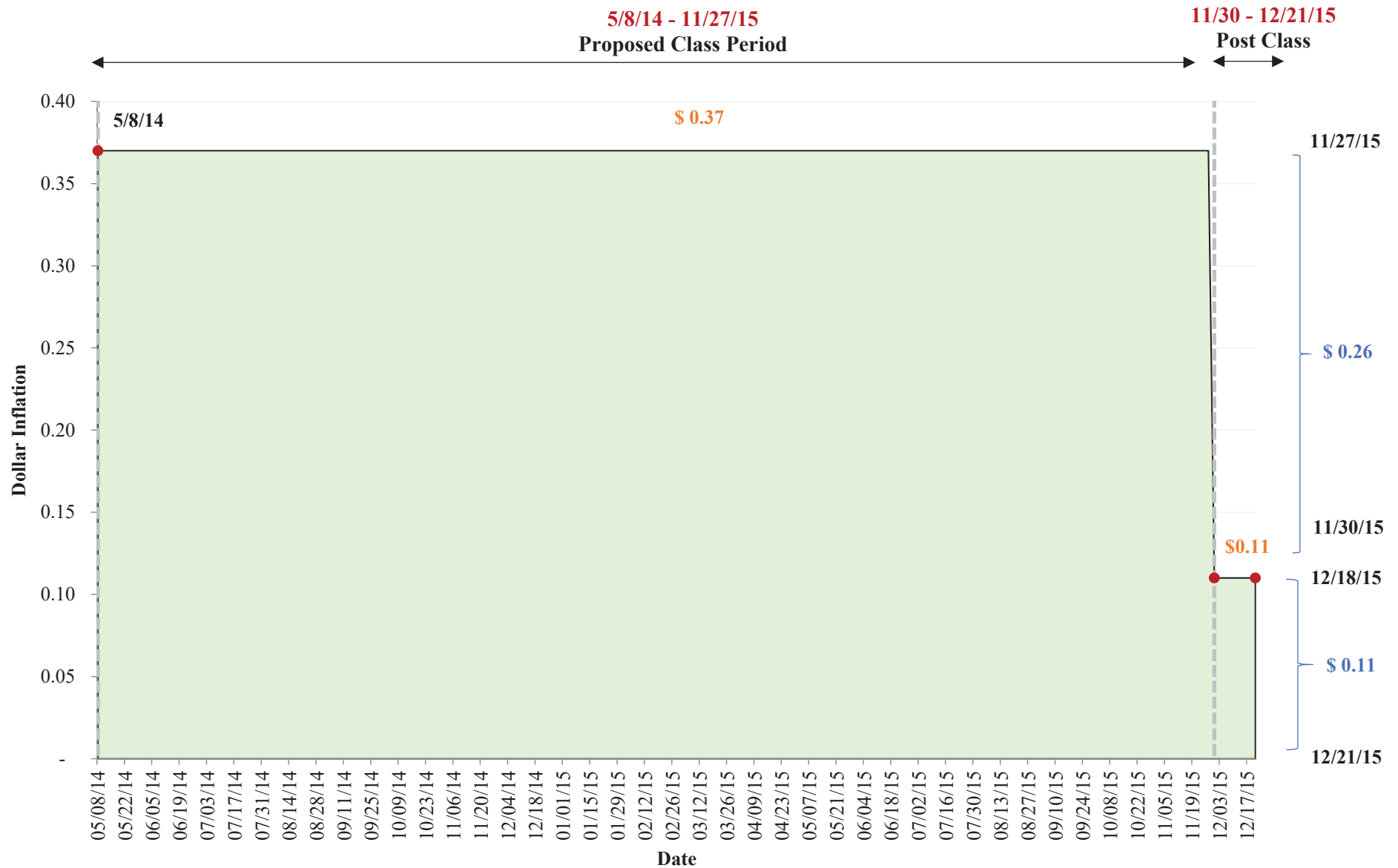


Exhibit 10
In re: Vale S.A. Securities Litigation
Inflation Ribbon During the Proposed Class Period between
May 8, 2014 and November 27, 2015 for Vale Preferred ADRs





Appendix A

JOHN D. FINNERTY, Ph.D.

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Professor of Finance, Gabelli School of Business, Fordham University

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New York, NY 10022

Email: jfinnerty@alixpartners.com

Dr. Finnerty recently transitioned to an Academic Affiliate in the Financial Advisory Services Group at AlixPartners, LLP, where he had previously served as a Managing Director for four years. He specializes in mortgage-backed securities; securities litigation; market manipulation cases and securities class actions; securities market efficiency analysis; matters involving investment banking, fixed income, corporate finance, and private equity issues; cases involving business, securities, and derivatives valuation; and matters requiring solvency analysis, calculation of damages, or statistical analysis. He provides litigation support for matters involving mortgage-backed securities, securities fraud, valuation disputes, solvency, portfolio mismanagement, fairness, breach of contract, breach of fiduciary duty, broker raiding, commercial disputes, and employment disputes. He has testified as an expert in matters involving mortgage-backed securities damages, securities appraisal, business valuation, solvency analysis, corporate finance, broker raiding, and other financial matters in federal and state court, arbitrations, and mediations. He has also testified as an expert in bankruptcy court concerning the valuation of businesses and securities, debt-for-debt exchange offers, and the fairness of proposed plans of reorganization.

Dr. Finnerty is also a Professor of Finance at Fordham University's Gabelli School of Business where he was the founding Director of the Master of Science in Quantitative Finance Program. He has taught for more than 31 years, including courses in corporate finance, investment banking, private equity and hedge funds, fixed income analysis, fixed income securities, fixed income portfolio management, principles of finance, securities innovation, and bankruptcy and reorganization. His teaching and research interests include the valuation of securities and derivative instruments, project financing, and private equity fund and hedge fund management, structure, and performance. He has developed innovative models for valuing convertible securities, employee

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stock options, restricted common stock, inflation-indexed bonds, venture capital preferred stock, emerging-growth firm common stock, and private equity carried interests.

Dr. Finnerty has published 16 books, including *Corporate Financial Management*, 5th ed., *Project Financing: Asset-Based Financial Engineering*, 3rd ed., *Principles of Financial Management*, and *Debt Management*, and more than 120 articles and professional papers in corporate finance, business and securities valuation, and other areas of finance. His writings and teaching have focused on the analysis and valuation of securities, especially fixed income instruments and complex derivative products, and mortgage-backed and other asset-backed securities. Dr. Finnerty is a former editor of *Financial Management*, one of the leading academic finance journals, and a former editor of *FMA Online*. He is a former member of the editorial boards of several finance and portfolio management journals.

Dr. Finnerty worked for more than 20 years as an investment banker. He worked on more than 50 public and private financings, served as financial advisor in connection with over a dozen mergers, and served as financial advisor and arranged financing for several project financings.

Dr. Finnerty is a Trustee and a former Chair of the Trustees and a former President and Director of the Eastern Finance Association, a former Director of the Financial Management Association, and a former President and Director of the Fixed Income Analysts Society. He served as a member of FASB's Option Valuation Group in connection with the revision of FAS 123. He was inducted into the *Fixed Income Analysts Society Hall of Fame* in 2011.

EDUCATION

1977	Ph.D. in Operations Research, Naval Postgraduate School
1973	B.A. and M.A. in Economics, Cambridge University; Marshall Scholar
1971	A.B. in Mathematics, Williams College; magna cum laude with highest honors in Mathematics; Rice Prize in Mathematics; Phi Beta Kappa

BUSINESS EXPERIENCE

2013 – Present	AlixPartners, LLP, New York, NY
2017 – Present	Academic Affiliate, Financial Advisory Services Group
2013 – 2017	Managing Director, Financial Advisory Services Group
2003 – 2013	Finnerty Economic Consulting, LLC, New York, NY
	Managing Principal

2001 - 2003	Analysis Group, Inc., New York, NY Managing Principal
1997 - 2001	PricewaterhouseCoopers, LLP, New York, NY Partner, Financial Advisory Services Group Dispute Analysis & Investigations securities litigation practice
1995 - 1997	Houlihan Lokey Howard & Zukin, New York, NY Director
1989 - 1995	McFarland Dewey & Co., New York, NY General Partner
1986 - 1989	College Savings Bank, Princeton, NJ Executive Vice President, Chief Financial Officer, Treasurer, Secretary, and Director
1982 - 1986	Lazard Frères & Company, New York, NY Vice President, Corporate Finance Department
1977 - 1982	Morgan Stanley & Co. Inc., New York, NY Associate, Corporate Finance Department

ACADEMIC EXPERIENCE

1987 - Present	Fordham University Gabelli School of Business, New York, NY Professor of Finance and founding Director of the Master of Science in Quantitative Finance Program. Received tenure in September 1991. Gladys and Henry Crown Award for Faculty Excellence, 1997.
1976 - 1977	Naval Postgraduate School, Monterey, CA Adjunct Professor, Department of Administrative Sciences
1973 - 1976	United States Naval Reserve Instructor, Naval Postgraduate School. Promoted to Lieutenant, USNR.

PROFESSIONAL ASSOCIATIONS

Chair of the Trustees, Eastern Finance Association (2009-2010), Trustee (2008-Present), President (2007-2008), and Director (2005-2008)

President, Fixed Income Analysts Society (2006-2007), and Director (2001-2009)

Director, Financial Management Association (1991-1999, 2005-2007, 2011-2013)

Editor, *Financial Management* (1993-1999)

Editor, *FMA Online* (2001-2010)

Associate Editor, *Journal of Derivatives Accounting* (2003-2005)

Associate Editor, *Journal of Applied Finance* (2000-2007, 2012-2016)

Associate Editor, *Journal of Financial Engineering* (1992-1999)

Member, Editorial Advisory Boards, *The Financier* (1995-2003), *Journal of Portfolio Management* (1995-2018), and *International Journal of Portfolio Analysis & Management* (2011-2018)

Globe Business Publishing Ltd., London, U.K., Globe Law and Business Reader Panel (2015-Present)

OTHER ACTIVITIES

Leadership Giving Co-Chair, Williams College Class of 1971

Co-chairman, New Jersey Special Gifts Program, Williams College Third Century Campaign

Member, Special Gifts Committee, New York City Area for Williams College Third Century Campaign

Vice Chairman, Williams College Class of 1971 25th Reunion Gift Committee

Treasurer and Trustee, Spring Lake Bath and Tennis Club, and Co-Chair, Finance Committee

AWARDS

Marshall Scholar, 1971

Gladys and Henry Crown Award for Faculty Excellence, Fordham Business School, 1997

Best Investments Paper, Southern Finance Association, 2001

Best Corporate Finance Paper, Southern Finance Association, 2006

Bene Merenti Medal, Fordham University, 2007

Fixed Income Analysts Society Hall of Fame, 2011

Achievements in Excellence Team Award, AlixPartners, LLP, 2014

Ashley Greater New York Community Service Award, 2018

EXPERT TESTIMONY IN LAST FOUR YEARS

<i>Clients</i>	<i>Case</i>	<i>Description of Testimony</i>
Kramer Levin Naftalis & Frankel Residential Capital Official Committee of Unsecured Creditors	In re: Residential Capital, LLC, et al., Debtors Residential Capital, LLC, et al. v. UMB Bank Official Committee of Unsecured Creditors v. UMB Bank U.S. Bankruptcy Court for the Southern District of New York Case No. 12-12020 (MG)	Prepared an expert report and a rebuttal expert report describing OID (original issue discount) bonds, explaining the discount as interest, calculating the amount of OID, describing incentives firms can give bondholders to exchange their bonds for new bonds when OID is created, and analyzing a debt-for-debt exchange offer Residential Capital conducted in 2008. Testified at deposition and at trial in bankruptcy court.
Internal Revenue Service	Sugarloaf Fund, LLC v. Commissioner of Internal Revenue United States Tax Court Chicago, IL Docket No. 671-10	Prepared an expert report concerning the market for distressed consumer receivables in Brazil and valuing three portfolios of distressed Brazilian consumer electronics receivables. Testified at trial in tax court.
Olshan Frome Wolosky	Iroquois Master Fund, Ltd. v. Quantum Fuel Systems Technologies Worldwide, Inc. U.S. District Court for the Southern District of New York Case No. 13 Civ. 3860	Prepared an expert report concerning the fair market value of an exchange right embedded in a corporate common stock warrant issued in a public offering and the impact of the warrant issue on the effective common stock price in a previously issued common stock warrant. Testified at deposition and at trial.
Kellogg, Huber, Hansen, Todd, Evans & Figel Korein Tillery	CMFG Life Insurance Company, et al. v. RBS Securities U.S. District Court for the Western District of Wisconsin Case No. 12-cv-00037 WMC	Prepared an expert report concerning the amount due to CMFG Life Insurance Company, CUMIS Insurance Society, and MEMBERS Life Insurance Company on their equitable rescission claim as a result of their purchase of residential mortgage-backed securities from RBS Securities. Testified at deposition.
Faegre Baker Daniels Sherman & Howard	The Pioneer Centres Holding Company Employee Stock Ownership Plan and Trust, et al. v. Alerus Financial and Berenbaum Weinshienk U.S. District Court for the District of Colorado Civil Action No. 1:12-cv-02547-RM-BNB	Prepared an expert report analyzing and comparing a proposed ESOP stock purchase and redemption transaction and a consummated asset purchase transaction, analyzing an independent transaction trustee's negotiating position with respect to the seller's representations and warranties, and assessing the plaintiffs' damages claims. Testified at deposition.
Quinn Emanuel Urquhart & Sullivan	In re Lehman Brothers Holdings, et al., v. JPMorgan Chase Bank U.S. Bankruptcy Court for the Southern District of New York Index No. 10-ap-03266	Prepared an expert report and a rebuttal expert report concerning the incremental value Lehman Brothers could have been realized from the sale of its investment management division if the bankruptcy of Lehman Brothers could have been delayed at least five business days. Testified at deposition.

<i>Clients</i>	<i>Case</i>	<i>Description of Testimony</i>
Ashurst Markit Group Limited	European Commission Statement of Objections of 1 July 2013 Case COMP/39.745 – CDS Information Market	Prepared an expert report and a supplemental expert report explaining why the CDS market was not ready for exchange trading by 2009, CDS dealers were unlikely to have had sufficient incentives to become the initial market makers, and a CDS CLOB exchange was unlikely to achieve lower trading costs and wider new investor demand.
Internal Revenue Service	AD Investment 2000 Fund LLC AD Global 2000 Fund LLC v. Commissioner of Internal Revenue United States Tax Court New York, NY Docket Nos. 9177-08 and 9178-08	Prepared an expert report concerning the reasonableness of profit expectation for a strategy involving a spread call option strategy. Testified at trial in tax court.
Luboj & Thau	Charles Schwab v. Morgan Stanley Smith Barney FINRA-DR Arbitration Arbitration No. 12-02325	Prepared an expert report concerning the damages resulting from the alleged raid of two California offices of Charles Schwab. Testified at arbitration.
Satterlee Stephens Burke & Burke	Oppenheimer & Co. Inc. v. Deutsche Bank Securities Inc. FINRA Arbitration FINRA Case No. 10-04093	Prepared an expert report and testified at arbitration concerning auction rate credit-linked notes, their intended market, the fair market of the AR CLNs at issuance, and Deutsche Bank's unjust enrichment.
Wollmuth Maher & Deutsch	Lehman Brothers Special Financing, Inc. v. Bank of America, et al. U.S. Bankruptcy Court for the Southern District of New York Case No. 10-03547 (SCC)	Prepared an expert report concerning the economic commonality of certain payment preference provisions across 48 CDO transactions in which Lehman Brothers Special Financing was involved as a credit default swap counterparty. Testified at deposition.
Robbins Geller Rudman & Dowd	Carpenters Pension Trust Fund of St. Louis, et al. v. Barclays plc, et al. U.S. District Court for the Southern District of New York Civil Action No. 1:12-cv-05329- SAS	Prepared an expert report on the efficiency of the market for the American depositary shares (ADS) on the Company's common stock in connection with a securities class action. Testified at deposition and at trial.
Fox Rothschild	In re: IH 1, Inc., et al., Debtors George L. Miller, Chapter 7 Trustee v. Kirkland & Ellis U.S. Bankruptcy Court for the District of Delaware Case No. 09-10982 (LSS)	Prepared an expert solvency report concerning an aluminum extrusion company. Testified at deposition.
Labaton Sucharow Robbins Geller Rudman & Dowd	In re Goldman Sachs Group, Inc. Securities Litigation U.S. District Court for the Southern District of New York Case No. 1:10-cv-03461-PAC	Prepared an expert report on the efficiency of the market for the Company's common stock in connection with a securities class action and a report on loss causation and damages. Testified at deposition and at trial.

<i>Clients</i>	<i>Case</i>	<i>Description of Testimony</i>
Internal Revenue Service	Endeavor Partners Fund, LLC, Delta Currency Trading, LLC, Tax Matters Partner, et al. v. Commissioner of Internal Revenue United States Tax Court New York, NY Docket Nos. 8698-12, 8710-12, 8721-12, 8846-12, 9975-12, 11290-12, and 12591-12	Prepared an expert rebuttal report responding to an expert report prepared by the taxpayer's expert, which provided an economic rationale underlying the taxpayer's business strategy. Testified at trial in tax court.
Boies, Schiller & Flexner Korein Tillery	Bruce S. Sherman v. Bear Stearns Companies Inc., et al. U.S. District Court for the Southern District of New York Index No. 09 Civ. 8161 (RWS)	Prepared an expert report in connection with a 10b-5 securities fraud matter concerning the efficiency of the market for the common stock of the Bear Stearns Companies, Inc., furnishing a loss causation analysis, and calculating the amount of damages sustained by Bruce Sherman due to the alleged fraud. Testified at deposition.
Arnold & Porter	AmTrust North America, Inc. v. SquareTrade, Inc. JAMS Arbitration No. 1100079447	Prepared an expert report concerning the improper sampling of consumer electronics claims submitted under the defendant's extended service plans and the incorrect calculation of damages by the plaintiff's experts. Testified at arbitration.
Humphrey, Farrington & McClain Klamann Law Firm White Graham Buckley & Carr	Dennis Demetre and Lori Lewis v. HMS Holdings Corp. Supreme Court of the State of New York, County of New York Index No. 652381/2012	Prepared an expert report identifying the expected synergies from a corporate merger; explaining due diligence, role of investment bankers, post-merger integration, and purpose of earn-outs in change-of-control transactions; analyzing the earn-out provision of a stock purchase agreement; and calculating the amount of damages sustained by the plaintiffs due to non-payment of the earn-out. Testified at deposition and at trial.
Schuyler, Roche & Crisham	UBS Financial Services Inc. v. David Kinnear, et al. FINRA Arbitration FINRA Case No. 12-00554	Prepared an expert report concerning the damages allegedly resulting from the improper solicitation of former clients by a broker in violation of his employment agreement. Testified at arbitration.
Securities and Exchange Commission	U.S. Securities and Exchange Commission v. Stifel, Nicolaus & Co., Inc. and David W. Noack U.S. District Court for the Eastern District of Wisconsin Case No. 2:11-cv-755	Prepared an expert report concerning collateralized debt obligations (CDOs) and analyzed three leveraged synthetic CDO transactions five Wisconsin school districts entered into in 2006, assessed the various risks, and opined on the accuracy of certain statements made to the school districts about those investment risks. Testified at deposition.
Kellogg, Huber, Hansen, Todd, Evans & Figel Korein Tillery	National Credit Union Administration Board v. Credit Suisse Securities (USA), et al. U.S. District Court for the Southern District of New York Case No. 13-cv-6736 (DLC)	Prepared an expert report and a rebuttal expert report that provide relevant background information concerning residential mortgage-backed securities (RMBS) and the market for RMBS and calculates the amounts of NCUA's claims for damages as a result of their purchase of RMBS from Credit Suisse. Testified at deposition.

<i>Clients</i>	<i>Case</i>	<i>Description of Testimony</i>
Kellogg, Huber, Hansen, Todd, Evans & Figel Korein Tillery	National Credit Union Administration Board v. Goldman Sachs, et al. U.S. District Court for the Southern District of New York Case No. 13-cv-6721 (DLC)	Prepared an expert report and a rebuttal expert report that provide relevant background information concerning residential mortgage-backed securities (RMBS) and the market for RMBS and calculates the amounts of NCUA's claims for damages as a result of their purchase of RMBS from Goldman Sachs. Testified at deposition.
Kellogg, Huber, Hansen, Todd, Evans & Figel Korein Tillery	National Credit Union Administration Board v. Goldman Sachs, et al. U.S. District Court for the Central District of California – Western Division Case No. 11-cv-6521 GW (JEMx)	Prepared an expert report and a rebuttal expert report that provide relevant background information concerning residential mortgage-backed securities (RMBS) and the market for RMBS and calculates the amounts of NCUA's claims for damages as a result of their purchase of RMBS from Goldman Sachs. Testified at deposition.
Kellogg, Huber, Hansen, Todd, Evans & Figel Korein Tillery	National Credit Union Administration Board v. UBS Securities U.S. District Court for the Southern District of New York Case No. 13-cv-6731 (DLC)	Prepared an expert report and a rebuttal expert report that provide relevant background information concerning residential mortgage-backed securities (RMBS) and the market for RMBS and calculates the amounts of NCUA's claims for damages as a result of their purchase of RMBS from UBS. Testified at deposition.
Goodmans	Ontario Superior Court of Justice (Commercial List) In the Matter of the Companies' Creditors Arrangement Act, R.S.C. 1985, c. C-36, as Amended And in the Matter of a Proposed Plan of Compromise or Arrangement with Respect to U.S. Steel Canada Inc. Court File No. CV-14-10695-00CL	Prepared an expert report concerning the distinguishing characteristics of debt and equity and evaluating from a financial point of view whether the principal terms of the U.S. Steel Canada Term Loan and Revolving Credit Loan were more equity-like than debt-like as of the date of issuance. Testified at trial in Toronto.
Labaton Sucharow	In re Amgen Inc., Securities Litigation U.S. District Court for the Central District of California Western Division Case No. CV 07-2536 PSG (PLAx)	Prepared expert report concerning loss causation and damages and prepared rebuttal and reply reports responding to defendants' expert reports concerning loss causation and damages issues. Testified at deposition.
Orrick, Herrington & Sutcliffe	Hemlock Semiconductor Corporation v. Deutsche Solar GmbH U.S. District Court for the Eastern District of Michigan Northern Division Case No. 1:13-CV-11037	Prepared an expert report explaining the economic characteristics of take-or-pay agreements, describing the benefits Deutsche Solar received under four supply agreements, identifying the harm to Hemlock resulting from the contract breaches, and quantifying the nominal value of Deutsche Solar's unfilled purchased obligations. Testified at deposition.

<i>Clients</i>	<i>Case</i>	<i>Description of Testimony</i>
Lowenstein Sandler	In re Petrobras Securities Litigation Case No. 14-cv-9662 (JSR) Discovery Global Citizens Master Fund, Ltd., et al. v. Petroleo Brasileiro S.A., et al. U.S. District Court for the Southern District of New York Case No. 15-cv-9126 (JSR)	Prepared an expert report concerning the efficiency of the market for the common ADS and preferred ADS of Petrobras and also concerning loss causation and damages to purchasers of the common ADS, preferred ADS, and an issue of Petrobras Global Finance notes in a 10b-5 and Section 11 securities fraud matter. Also prepared a reply report. Testified at deposition.
Kellogg, Huber, Hansen, Todd, Evans & Figel Korein Tillery	National Credit Union Administration Board v. Credit Suisse Securities (USA), et al. U.S. District Court for the District of Kansas Case No. 12-2648 JWL/JPO	Prepared an expert report and a rebuttal expert report that provide relevant background information concerning residential mortgage-backed securities (RMBS) and the market for RMBS and calculates the amounts of NCUA's claims for damages as a result of their purchase of RMBS from Credit Suisse. Testified at deposition.
Kellogg, Huber, Hansen, Todd, Evans & Figel Korein Tillery	National Credit Union Administration Board v. UBS Securities, et al. U.S. District Court for the District of Kansas Case No. 12-cv-2591 JWL	Prepared an expert report and a rebuttal expert report that provide relevant background information concerning residential mortgage-backed securities (RMBS) and the market for RMBS and calculates the amounts of NCUA's claims for damages as a result of their purchase of RMBS from UBS. Testified at deposition.
Susman Godfrey	GE Funding Capital Market Services, Inc. and Trinity Funding Company, LLC v. Nebraska Investment Finance Authority U.S. District Court for the Southern District of New York 15 Civ.1069 (LGS)	Prepared an expert report explaining how the defendant's unilateral extension of seven GIC contracts after the associated municipal bonds were redeemed reflected a valuable option, for which plaintiffs would have charged in the GIC contract prices if they had intended the contracts to incorporate such an extension option. Testified at deposition.
Lewis Roca Rothgerber Christie	James J. Cotter, Jr. v. Margaret Cotter, et al. District Court, Clark County, Nevada Case No. A-15-719860-B, Dept. No. XI	Prepared a rebuttal expert report opining on the event study and other statistical analyses and the conclusions in an expert report submitted by the defendants' expert. Testified at deposition.
Sullivan & Cromwell	In re: Term Commodities Cotton Futures Litigation U.S. District Court for the Southern District of New York Master Docket No. 12-cv-5126 (ALC) (KNF)	Prepared a responsive expert report and a rebuttal expert report opining on the event studies, supply of storage models, and other statistical analyses and the conclusions in several expert reports submitted by the plaintiffs' expert. Testified at deposition.
Coss and Momjian	Stephen Todd Walker v. Morgan Stanley Smith Barney, LLC, et al. FINRA Arbitration FINRA Case Nos. 10-04094, 10-04888, and 11-01780	Prepared an expert report and an expert rebuttal report concerning the damages allegedly suffered by a registered representative due to tortious interference, defamation, unfair competition, and conversion by a broker dealer. Testified at arbitration.

<i>Clients</i>	<i>Case</i>	<i>Description of Testimony</i>
Bernstein Litowitz Berger & Grossmann Labaton Sucharow	In re Facebook, Inc., IPO Securities and Derivative Litigation U.S. District Court for the Southern District of New York MDL No. 12-2389 (RWS)	Prepared an expert report and a rebuttal expert report concerning the damages allegedly suffered by plaintiffs due to material misstatements and omissions in an IPO prospectus under Sections 11 and 12 of the Securities Act of 1933 and responding to conclusions in expert reports submitted by the defendants' experts. Testified at deposition.
Grais & Ellsworth	Federal Deposit Insurance Corporation as Receiver for Colonial Bank v. Credit Suisse First Boston Mortgage Securities Corp., et al. Circuit Court of Montgomery County, Alabama Civil Action No. 03-CV-2012- 901035.00	Prepared an expert report that calculates the amounts of damages Colonial Bank allegedly suffered as a result of its purchase of RMBS from the defendants. Damages are calculated under Sections 11 and 12 of the Securities Act of 1933 and under the blue sky laws of the states of Alabama and Nevada. Testified at deposition.
Grais & Ellsworth	Federal Deposit Insurance Corporation as Receiver for Colonial Bank v. Morgan Stanley & Co., et al. Circuit Court of Montgomery County, Alabama Civil Action No. 03-CV-2012- 901036.00	Prepared an expert report that calculates the amounts of damages Colonial Bank allegedly suffered as a result of its purchase of RMBS from the defendants. Damages are calculated under Sections 11 and 12 of the Securities Act of 1933 and under the blue sky laws of the states of Alabama and Nevada. Testified at deposition.
Kellogg, Hansen, Todd, Figel & Frederick Korein Tillery	CMFG Life Insurance Company, et al. v. Morgan Stanley & Co. U.S. District Court for the Western District of Wisconsin Case No. 13-cv-577 (JDP)	Prepared an expert report that calculates the amounts of damages the plaintiffs allegedly suffered as a result of their purchase of RMBS from the defendant. Damages are calculated under equitable common law. Testified at deposition.
Lowenstein Sandler	Broadway Gate Master Fund, Ltd., et al. v. Ocwen Financial Corporation, et al. U.S. District Court for the Southern District of Florida Case No. 9:16-CV-80056-WPD	Prepared an expert report concerning the efficiency of the market for the common stock of Ocwen Financial and also concerning loss causation and damages to purchasers of the common stock in a 10b-5 securities fraud opt-out matter. Testified at deposition.
Grais & Ellsworth	Federal Deposit Insurance Corporation as Receiver for United Western Bank v. RBS Acceptance Inc., et al. U.S. District Court for the District of Colorado Civil Action No. 1:14-cv-00418- PAB-MJW	Prepared an expert report that calculates the amount of damages United Western Bank allegedly suffered as a result of its purchase of RMBS from the defendants. Damages are calculated under the blue sky laws of the state of Colorado. Testified at deposition.
Shumaker, Loop & Kendrick	Ameriprise Financial Services v. Cheryle Anne Brady FINRA Arbitration FINRA Case No. 16-03368	Prepared an expert report concerning the damages allegedly suffered by a registered representative who claimed to have been wrongfully terminated by a broker dealer. Testified at arbitration.

<i>Clients</i>	<i>Case</i>	<i>Description of Testimony</i>
Mandel Bhandari	Scantibodies Laboratory, Inc. v. Church & Dwight Co., Inc. U.S. District Court for the Southern District of New York 14 Civ. 2275 (JGK)	Prepared an expert report opining as to the amount of lost-profits damages suffered by Scantibodies Laboratory resulting from the alleged breaches of two manufacture and supply agreements. Testified at deposition.
Pryor Cashman	Carbures Europe, S.A., et al. v. Emerging Markets Intrinsic Cayman Ltd., et al. Supreme Court of the State of New York, County of New York Index No. 653892/15	Prepared an expert report explaining what hedging common stock price risk exposure involves, distinguishing such hedging from simply selling shares of common stock without regard for the risk being offset, describing alternative mechanisms for settling liabilities through the payment of cash or the delivery of securities, and explaining why settling a liability through payment in shares of common stock is not costless. Testified at deposition and at trial.
Orrick, Herrington & Sutcliffe	Hemlock Semiconductor Group v. Kyocera Corporation U.S. District Court for the Eastern District of Michigan Northern Division Case No. 1:15-CV-11236	Prepared a presentation explaining why the long-term solar-grade polysilicon purchase agreements at issue in the matter were similar to projecting financing arrangements and were consequently sound based on economic principles.
Hunton & Williams	AMCO Insurance Company, et al. v. CoBank, ACB U.S. District Court for the Southern District of New York Case No. 16-cv-4422 (LTS)	Prepared an expert report and a rebuttal report explaining how institutional investors could reasonably be expected to invest the cash proceeds from an allegedly premature bond redemption and calculated damages. Testified at deposition.
Grais & Ellsworth	Federal Deposit Insurance Corporation as Receiver for Guaranty Bank v. Goldman, Sachs, et al. U.S. District Court for the Western District of Texas Austin Division Civil Action No.14-cv-129-SS	Prepared an expert report that calculates the amount of damages Guaranty Bank allegedly suffered as a result of its purchase of RMBS from the defendants. Damages are calculated under the blue sky laws of the state of Texas. Testified at deposition.
Grais & Ellsworth	Federal Deposit Insurance Corporation as Receiver for Guaranty Bank v. RBS Securities U.S. District Court for the Western District of Texas Austin Division Civil Action No. 14-cv-126-SS	Prepared an expert report that calculates the amount of damages Guaranty Bank allegedly suffered as a result of its purchase of RMBS from the defendant. Damages are calculated under the blue sky laws of the state of Texas. Testified at deposition.
Robbins Geller Rudman & Dowd	China Development Industrial Bank v. Morgan Stanley, et al. Supreme Court of the State of New York, County of New York Index No. 650957/2010	Prepared an expert report and a reply expert report calculating the plaintiff's damages under a credit default swap mark-to-market theory and also under a rescission theory. Testified at deposition.

<i>Clients</i>	<i>Case</i>	<i>Description of Testimony</i>
Orrick, Herrington & Sutcliffe	Hemlock Semiconductor Corporation v. Green Energy Technology and Tatung Co. of America State of Michigan in the Circuit Court for the County of Saginaw Case No. 13-020593-CK-1	Prepared an expert report and an expert rebuttal report opining as to the reliability of the spot market prices PVinsights reports for solar-grade polycrystalline silicon and calculating damages resulting from the repudiation of a long-term purchase agreement for solar-grade polycrystalline silicon. Testified at deposition.
Hughes Hubbard & Reed	Credit Suisse Securities (USA) LLC v. UBS Financial Services, Inc. FINRA Arbitration FINRA Case No. 15-03186	Prepared an expert report and an expert rebuttal report opining as to the damages allegedly resulting from the improper hiring of registered representatives by a former competitor when a broker-dealer closed its U.S. high-net-worth wealth management business. Testified at arbitration.
Coss & Momjian Gregory, Doyle, Calhoun & Rogers	HA&W Capital Partners, LLC, et al. v. Niraj Nicholas Bhandari, et al. v. HA&W Holdings, LLC Superior Court of Cobb County, State of Georgia Civil Action No. 14-1-2408-53	Prepared an expert report calculating damages resulting from alleged breaches of employment contracts when four brokers left their employer without giving proper notice and joined a competing broker-dealer. Testified at deposition.
Foley & Lardner	Cortlandt Street Recovery Corp. and Wilmington Trust Company, as Trustee, v. David Bonderman, et al. Supreme Court of the State of New York, County of New York Index No. 653357/2011	Prepared an expert report and an expert rebuttal report opining that the terms of the Convertible Preferred Equity Certificates (CPECs) issued by affiliates of the Defendants and the manner in which they were administered are more typical of equity than debt and that the offering memorandum for a subsequent issue of PIKs is confusing in their characterization of the CPECs.

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Books

1. John D. Finnerty, An Illustrated Guide to Bond Refunding Analysis. The Financial Analysts Research Foundation, Charlottesville, VA, 1984.
2. John D. Finnerty, Corporate Financial Analysis: A Comprehensive Guide to Real-World Approaches for Financial Managers. McGraw-Hill Book Company, New York, 1986.
 - a) Main Selection: Macmillan's The Executive Program
 - b) Alternate Selection: Prentice-Hall's Books for Accountants
3. John D. Finnerty, Andrew J. Kalotay, and Francis X. Farrell, Jr., The Financial Manager's Guide to Evaluating Bond Refunding Opportunities. Ballinger Publishing Company, Cambridge, MA, 1988.
4. Douglas R. Emery and John D. Finnerty, Principles of Finance with Corporate Applications. West, St. Paul, MN, 1991.
5. John D. Finnerty and Martin S. Fridson, eds., The Yearbook of Fixed Income Investing 1995. Irwin Professional Publishing, Chicago, 1996.
6. John D. Finnerty, Project Financing: Asset-Based Financial Engineering. John Wiley & Sons, New York, 1996.
7. Douglas R. Emery and John D. Finnerty, Corporate Financial Management. Prentice Hall, Upper Saddle River, NJ, 1997.
8. Douglas R. Emery, John D. Finnerty, and John D. Stowe, Principles of Financial Management. Prentice Hall, Upper Saddle River, NJ, 1998.
9. John D. Finnerty and Douglas R. Emery, Debt Management. Harvard Business School Press, Boston, 2001.
10. Douglas R. Emery, John D. Finnerty, and John D. Stowe, Corporate Financial Management, 2nd ed. Prentice Hall, Upper Saddle River, NJ, 2004.
11. Douglas R. Emery, John D. Finnerty, and John D. Stowe, Corporate Financial Management, 3rd ed. Prentice Hall, Upper Saddle River, NJ, 2007.
12. Douglas R. Emery, John D. Finnerty, and John D. Stowe, Corporate Financial Management, Int. ed. Prentice Hall, Upper Saddle River, NJ, 2007.
13. John D. Finnerty, Project Financing: Asset-Based Financial Engineering, 2nd ed. John Wiley & Sons, New York, 2007.
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15. John D. Finnerty, Project Financing: Asset-Based Financial Engineering, 3rd ed. John Wiley & Sons, New York, 2013.
16. Douglas R. Emery, John D. Finnerty, and John D. Stowe, Corporate Financial Management, 5th ed. Wohl Publishing, Morristown, NJ, 2018.

Monographs

1. John D. Finnerty, "The PricewaterhouseCoopers Credit Derivatives Primer," PricewaterhouseCoopers LLP, New York, 1998.
2. John D. Finnerty, "Structuring Derivative Instruments to Adjust Risk Exposure: The Arithmetic of Financial Instruments," PricewaterhouseCoopers LLP, New York, 1999.
3. John D. Finnerty, "A Comparison of Alternative Models for Valuing Employee Stock Options," Financial Executives Research Foundation, Florham Park, NJ, January 2003.

Papers Published in Refereed Journals

1. John D. Finnerty, "How Often Will the Firemen Get Their Sleep?," Management Science (July 1977), pp. 1169-1173.
2. John D. Finnerty, "Real Money Balances and the Firm's Production Function," Journal of Money, Credit and Banking (November 1980), pp. 666-671.
3. John D. Finnerty, "The Behavior of Electric Utility Common Stock Prices Near the Ex-Dividend Date," Financial Management (Winter 1981), pp. 59-69.
4. John D. Finnerty, "The Stock Market's Reaction to the Switch from Flow-Through to Normalization," Financial Management (Winter 1982), pp. 36-47.
5. John D. Finnerty, "Evaluating the Economics of Refunding High-Coupon Sinking-Fund Debt," Financial Management (Spring 1983), pp. 5-10.
6. John D. Finnerty, "Bank Discount, Coupon Equivalent, and Compound Yields: Comment," Financial Management (Summer 1983), pp. 40-44.
7. John D. Finnerty, "Preferred Stock Refunding Analysis: Synthesis and Extension," Financial Management (Autumn 1984), pp. 22-28.
8. John D. Finnerty, "Stock-for-Debt Swaps and Shareholder Returns," Financial Management (Autumn 1985), pp. 5-17.
9. John D. Finnerty, "Zero Coupon Bond Arbitrage: An Illustration of the Regulatory Dialectic at Work," Financial Management (Winter 1985), pp. 13-17.
10. John D. Finnerty, "Refunding Discounted Debt: A Clarifying Analysis," Journal of Financial and Quantitative Analysis (March 1986), pp. 95-106.

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13. John D. Finnerty, "Capital Budgeting and CAPM: Choosing the Market Risk Premium," Journal of Corporate Finance (Winter 1988), pp. 11-14.
14. John D. Finnerty, "Financial Engineering in Corporate Finance: An Overview," Financial Management (Winter 1988), pp. 14-33. (Lead Article) Reprinted in Clifford W. Smith, Jr., and Charles W. Smithson, eds., The Handbook of Financial Engineering. Harper & Row, New York, 1990, ch. 3, and in Robert W. Kolb, ed., The Financial Derivatives Reader. Kolb, Miami, 1992, ch. 2.
15. John D. Finnerty, "New Issue Dividend Reinvestment Plans and the Cost of Equity Capital," Journal of Business Research (March 1989), pp. 127-139.
16. John D. Finnerty, "Measuring the Duration of a Floating-Rate Bond," Journal of Portfolio Management (Summer 1989), pp. 67-72. Reprinted in Sanjay K. Nawalkha and Donald R. Chambers, eds., Interest Rate Risk Measurement and Management. Institutional Investor Books, New York, 1999, ch. 32.
17. John D. Finnerty and Victor M. Borun, "An Analysis of Unbundled Stock Units," Global Finance Journal (Fall 1989), pp. 47-69.
18. John D. Finnerty and Michael Rose, "Arbitrage-Free Spread: A Consistent Measure of Relative Value," Journal of Portfolio Management (Spring 1991), pp. 65-77.
19. John D. Finnerty, "The Time Warner Rights Offerings: A Case Study in Financial Engineering," Journal of Financial Engineering (June 1992), pp. 38-61.
20. John D. Finnerty, "The Advance Refunding of Nonredeemable High-Coupon Corporate Debt Through In-Substance Defeasance," Journal of Financial Engineering (September 1992), pp. 150-173.
21. Douglas R. Emery and John D. Finnerty, "A Review of Recent Research Concerning Corporate Debt Provisions," Financial Markets, Institutions & Instruments (December 1992), pp. 23-39.
22. John D. Finnerty and Dean Leistikow, "College Tuition Prepayment Programs: Description, Investment Portfolio Composition, and Contract Pricing," Journal of the Midwest Finance Association (1992), pp. 165-174.
23. John D. Finnerty, "Comment: The Need to Enhance the Effectiveness of Discussants and Some Suggested Guidelines for Session Organizers and Discussants," Financial Practice and Education (Spring/Summer 1993), pp. 15-18.

24. John D. Finnerty and Dean Leistikow, "The Behavior of Equity and Debt Risk Premiums," Journal of Portfolio Management (Summer 1993), pp. 73-84.
25. John D. Finnerty, "Interpreting SIGNs," Financial Management (Summer 1993), pp. 34-47.
26. John D. Finnerty, "Indexed Sinking Fund Debentures: Valuation and Analysis," Financial Management (Summer 1993), pp. 76-93.
27. John D. Finnerty and Robert J. Kunze, "Arranging Financing for Biotechnology Ventures," Financier (May 1994), pp. 20-34.
28. John D. Finnerty, "Valuing Corporate Equity When Value Additivity May Not Hold: The Case of the Newhouse Estate Valuation," Financial Practice and Education (Spring/Summer 1994), pp. 107-115.
29. John D. Finnerty and Dean Leistikow, "The Behavior of Equity and Debt Risk Premiums": Reply to Comment, Journal of Portfolio Management (Summer 1994), pp. 101-102.
30. John D. Finnerty, "Range Floaters: Pricing a Bet on the Future Course of Short-Term Interest Rates," Financier (November 1994), pp. 20-27. Reprinted in John D. Finnerty and Martin S. Fridson, eds., The Yearbook of Fixed Income Investing 1995. Irwin Professional Publishing, Chicago, 1996, ch. 8.
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37. John D. Finnerty and Mark S. Brown, "An Overview of Derivatives Litigation, 1994 to 2000," Fordham Journal of Corporate & Financial Law (vol.7, 2001), pp. 131-158.
38. John D. Finnerty and Dwight Grant, "Alternative Approaches to Testing Hedge Effectiveness under SFAS No. 133," Accounting Horizons (June 2002), pp. 95-108.

39. John D. Finnerty and Douglas R. Emery, "Corporate Securities Innovation: An Update," Journal of Applied Finance (Spring/Summer 2002), pp. 21-47.
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49. John D. Finnerty, "Using Contingent-Claims Analysis to Value Opportunities Lost Due to Moral Hazard Risk," Journal of Risk (Spring 2006), pp. 55-83.
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52. John D. Finnerty, "A Closer Look at Correction for False Discovery Bias When Making Multiple Comparisons," Journal of Forensic Economics (December 2009), pp. 55-62.

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55. John D. Finnerty, Jie Jiao, and An Yan, "Convertible Securities in Merger Transactions," Journal of Banking and Finance (January 2012), pp. 275-289.
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61. John D. Finnerty, "Using Put Option-Based DLOM Models to Estimate Discounts for Lack of Marketability," Business Valuation Review (Fall 2013), pp. 165-170.
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Appendix C-1

In re: Vale S.A. Securities Litigation

**Members of the S&P Metals and Mining Select Industry Total Return Index
During the Proposed Class Period**

# of Members		39	37	39	34	32	32	28	25
Bloomberg Ticker	Company Name	03/31/14	06/30/14	09/30/14	12/31/14	03/31/15	06/30/15	09/30/15	12/31/15
AA UN Equity	ALCOA CORP	x	x	x	x	x	x	x	x
ATI UN Equity	ALLEGHENY TECHNOLOGIES INC	x	x	x	x	x	x	x	x
MTRN UN Equity	MATERION CORP	x	x	x	x	x	x	x	x
CMC UN Equity	COMMERCIAL METALS CO	x	x	x	x	x	x	x	x
CNX UN Equity	CNX RESOURCES CORP	x	x	x	x	x	x	x	x
BTUUQ UN Equity	PEABODY ENERGY CORP	x	x	x	x	x	x	x	
SWC UN Equity	STILLWATER MINING CO	x	x	x	x	x	x	x	x
TVIAQ UW Equity	TERRAVIA HOLDINGS INC	x	x	x					
CMP UN Equity	COMPASS MINERALS INTERNATION	x	x	x	x	x	x	x	x
X UN Equity	UNITED STATES STEEL CORP	x	x	x	x	x	x	x	x
AKS UN Equity	AK STEEL HOLDING CORP	x	x	x	x	x	x	x	x
CENX UW Equity	CENTURY ALUMINUM COMPANY	x	x	x	x	x	x		
CLF UN Equity	CLEVELAND-CLIFFS INC	x	x	x	x	x	x	x	x
RTI UN Equity	RTI INTERNATIONAL METALS INC	x	x	x	x	x	x		
SLCA UN Equity	US SILICA HOLDINGS INC	x	x	x					
CRS UN Equity	CARPENTER TECHNOLOGY	x	x	x	x	x	x	x	x
ACI IQ UN Equity	ARCH COAL INC	x	x	x	x				
CDE UN Equity	COEUR MINING INC	x	x	x	x	x	x	x	x
HAYN UW Equity	HAYNES INTERNATIONAL INC	x	x	x	x	x	x	x	x
ANRZQ UN Equity	ALPHA NATURAL RESOURCES INC	x	x	x	x				
RGLD UW Equity	ROYAL GOLD INC	x	x	x	x	x	x	x	x
HL UN Equity	HECLA MINING CO	x	x	x	x	x	x	x	x
SCHN UW Equity	SCHNITZER STEEL INDS INC-A	x	x	x	x	x	x	x	x
RS UN Equity	RELIANCE STEEL & ALUMINUM	x	x	x	x	x	x	x	x
WLTGQ UN Equity	WALTER ENERGY INC	x	x	x					
GSM UW Equity	FERROGLOBE PLC	x	x	x	x	x	x	x	x
KALU UW Equity	KAISER ALUMINUM CORP	x	x	x	x	x	x	x	x
FCX UN Equity	FREEPORT-MCMORAN INC	x	x	x	x	x	x	x	x
ACO UN Equity	AMCOL INTERNATIONAL CORP	x							
ZINCQ UW Equity	AMERICAN ZINC RECYCLING LLC	x	x	x	x	x	x	x	
WOR UN Equity	WORTHINGTON INDUSTRIES	x	x	x	x	x	x	x	x
SXC UN Equity	SUNCOKE ENERGY INC	x	x	x	x	x	x	x	
ANVGQ UA Equity	HYCROFT MINING CORP	x							
CLDP UN Equity	CLOUD PEAK ENERGY INC	x	x	x	x	x	x		
MCPIQ UN Equity	MOLYCORP INC	x	x	x					
MUX UN Equity	MCEWEN MINING INC	x	x	x					
NEM UN Equity	NEWMONT GOLDCORP CORP	x	x	x	x	x	x	x	x
STLD UW Equity	STEEL DYNAMICS INC	x	x	x	x	x	x	x	x
NUE UN Equity	NUCOR CORP	x	x	x	x	x	x	x	x
TMST UN Equity	TIMKENSTEEL CORP			x	x	x	x	x	x
WLBAQ UQ Equity	WESTMORELAND COAL CO			x	x	x	x		

Note:

^[1] The S&P Metals and Mining Select Industry Total Return Index (SPSIMMTR Index) provides investors with an equity benchmark for U.S.-traded Metals and Mining-related securities.

Source: Bloomberg L.P.

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Appendix C-2

In re: Vale S.A. Securities Litigation
Members of the Bovespa Index During the Proposed Class Period
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# of Members (Excluding Vale S.A.)		70	69	68	67	68	66	64	62	61	59
Bloomberg Ticker	Company Name	05/02/14	05/05/14	07/04/14	09/01/14	10/06/14	01/05/15	05/04/15	09/08/15	10/16/15	01/04/16
MRFG3 BS Equity	MARFRIG GLOBAL FOODS SA	x	x	x	x	x	x	x	x	x	x
GOAU4 BS Equity	METALURGICA GERDAU SA-PREF	x	x	x	x	x	x	x	x	x	x
MMXM3 BS Equity	MMX MINERACAO E METALICOS SA		x	x							
MRVE3 BS Equity	MRV ENGENHARIA	x	x	x	x	x	x	x	x	x	x
NATU3 BS Equity	NATURA COSMETICOS SA	x	x	x	x	x	x	x	x	x	x
OIBR4 BS Equity	OI SA-PREFERENCE	x	x	x	x	x	x	x	x		
PDGR3 BS Equity	PDG REALTY SA	x	x	x	x	x	x				
PETR3 BS Equity	PETROBRAS - PETROLEO BRAS	x	x	x	x	x	x	x	x	x	x
PETR4 BS Equity	PETROBRAS - PETROLEO BRAS-PR	x	x	x	x	x	x	x	x	x	x
PRML3 BS Equity	PRUMO LOGISTICA SA	x									
RSID3 BS Equity	ROSSI RESIDENCIAL SA	x	x	x	x	x					
ALLL3 BS Equity	RUMO SA	x	x	x	x	x	x				
CRUZ3 BS Equity	SOUZA CRUZ LTDA	x	x	x	x	x	x	x	x		
SUZB5 BS Equity	SUZANO PAPEL E CELULO-PREF A	x	x	x	x	x	x	x	x	x	x
VIVT4 BS Equity	TELEFONICA BRASIL S.A.-PREF	x	x	x	x	x	x	x	x	x	x
TIMP3 BS Equity	TIM PARTICIPACOES SA	x	x	x	x	x	x	x	x	x	x
UGPA3 BS Equity	ULTRAPAR PARTICIPACOES SA	x	x	x	x	x	x	x	x	x	x
USIM5 BS Equity	USINAS SIDER MINAS GER-PF A	x	x	x	x	x	x	x	x	x	x
VALE3 BS Equity	VALE SA										
VALE5 BS Equity	VALE SA-PREF										
BBSE3 BS Equity	BB SEGURIDADE PARTICIPACOES	x	x	x	x	x	x	x	x	x	x
ECOR3 BS Equity	ECORODOVIAS INFRA E LOG SA	x	x	x	x	x	x	x	x	x	x
EGIE3 BS Equity	ENGIE BRASIL ENERGIA SA	x	x	x	x	x	x	x	x	x	x
ESTC3 BS Equity	ESTACIO PARTICIPACOES SA	x	x	x	x	x	x	x	x	x	x
EVEN3 BS Equity	EVEN CONSTRUTORA E INCORPORA	x	x	x	x	x	x				
KLBN11 BS Equity	KLABIN SA - UNIT	x	x	x	x	x	x	x	x	x	x
QUAL3 BS Equity	QUALICORP CONS E CORR SEG SA	x	x	x	x	x	x	x	x	x	x
POMO4 BS Equity	MARCOPOLO SA-PREF				x	x	x	x			
RLOG3 BS Equity	COSAN LOGISTICA SA					x					
MULT3 BS Equity	MULTIPLAN EMPREENDIMENTOS						x	x	x	x	x
SMLS3 BS Equity	SMILES FIDELIDADE SA							x	x	x	x
RUMO3 BS Equity	RUMO LOGISTICA OPERADORA MUL							x	x	x	x
RADL3 BS Equity	RAIA DROGASIL SA								x	x	x
EQTL3 BS Equity	EQUATORIAL ENERGIA SA - ORD								x	x	x
WEGE3 BS Equity	WEG SA										x

Note:

^[1] Bovespa Index (IBOV Index) is adjusted to exclude Vale S.A. common and preferred stocks from the index, and represents the gross total return index weighted by free float market cap comprised of the most liquid stocks traded on the Sao Paulo Stock Exchange.

Source: Bloomberg L.P.

Appendix C-3
In re: Vale S.A. Securities Litigation
Levene Test and Chow Test for Structural Breaks

Panel A. Levene Test ^[1]

Subperiod	From	To
1	5/8/2014	5/11/2015
2	5/12/2015	11/27/2015

Null Hypothesis (H_0):

Variance between series are equal.

Levene Test	Vale Common ADRs	Vale Preferred ADRs
p-value	0.3783	0.7887

Panel B. Chow Test

Null Hypothesis (H_0):

No break at the specified breakpoint, 5/12/2015

Chow Test	Vale Common ADRs	Vale Preferred ADRs
p-value	0.0061	0.0056

Notes:

- ^[1] The Levene test is a statistical procedure that tests whether the variances of two series are equal. The residuals or abnormal returns between two subperiods are tested excluding the fraud-related event dates.
- ^[2] The Chow test is a statistical procedure that tests whether the regression coefficients across different subperiods are equal. The test is performed excluding the fraud-related event dates.

In re: Vale S.A. Securities Litigation

Calculation of Abnormal Returns Using the Modified Fama-French Three-Factor Model Including
(1) the S&P Metals and Mining Select Industry Total Return Index,
(2) the Bovespa Market Index, and
(3) the Daily Return of Brazilian Real in \$USD

Vale Common ADRs

Estimation Period: May 8, 2013 through May 7, 2014 (One Year Prior to Proposed Class Period) ^[1]

Panel A. Fitting the Modified Fama-French Three-Factor Model ^[2]

Regression: $R_{VALE,COM} - R_F = \beta_0 + \beta_1(Mkt - R_F) + \beta_2(SMB) + \beta_3(HML) + \beta_4(\text{S\&P Metals \& Mining Select Industry Total Return Index}) + \beta_5(\text{Bovespa}) + \beta_6(\text{Exchange Rate})$

Period: 5/8/2013 - 5/7/2014

	Coeff.	StdErr	t-stat	p-value		
β_0	-0.0001	0.0009	-0.1639	0.8699	R-squared	57.58%
β_1	-0.1927	0.1436	-1.3418	0.1810	Adjusted R-squared	56.45%
β_2	-0.5680	0.2245	-2.5299	0.0121	S.E. of regression	1.38%
β_3	-0.0948	0.2562	-0.3700	0.7117	Sum squared resid	0.0427
β_4	0.6755	0.0842	8.0261	0.0000	Log likelihood	671.7121
β_5	0.5661	0.0935	6.0557	0.0000	F-statistic	51.1210
β_6	0.6427	0.1133	5.6714	0.0000		

Panel B. Calculation of the Abnormal Return(s) on Select Date(s)

Date	R _F	Mkt-R _F	SMB	HML	Industry	Bovespa	BRL in USD	Predicted Return	Actual Return	Abnormal Return	t-stat	p-value	Sig
Remaining Misrepresentations and/or Omissions in the Amended Complaint													
5/8/14	0.00%	-0.26%	-1.00%	0.34%	-1.11%	-1.12%	0.13%	-0.73%	-1.33%	-0.60%	-0.435	0.664	
11/16/15	0.00%	1.39%	-0.58%	0.46%	1.37%	0.84%	0.69%	1.85%	0.25%	-1.59%	-1.159	0.248	
Remaining Partial Corrective Disclosures in the Amended Complaint													
11/6/15	0.00%	0.14%	0.81%	0.27%	-0.87%	-2.09%	0.23%	-2.15%	-5.69%	-3.54%	-2.576	0.011	**
11/30/15	0.00%	-0.47%	0.14%	0.69%	0.96%	-1.44%	-0.58%	-0.60%	-5.60%	-5.00%	-3.636	0.000	***
12/21/15	0.00%	0.74%	-0.18%	-0.06%	1.22%	-1.21%	-0.76%	-0.40%	-4.06%	-3.66%	-2.665	0.008	***

Notes:

^[1] On Friday, November 27, 2015, after the market closed, the Brazilian government stated its intent to file suit against Vale, BHP, and Samarco for \$5.2 billion. The stock price impact was reflected the following trading day on November 30, 2015.

^[2] Modified Fama-French Three-Factor model was run with the White heteroskedasticity adjustment for heteroskedasticity-adjusted standard errors.

The S&P Metals & Mining Select Industry Index (SPSMMTR Index) is managed by S&P Dow Jones Indices LLC and is a modified equal-weighted index that is designed to measure the performance of stocks in the S&P Total Market Index that both (i) are classified under the Global Industry Classification Standard (GICS) in the aluminum, coal & consumable fuels, copper, diversified metals & mining, gold, precious metals & minerals, silver or steel sub-industries and (ii) satisfy one of the float-adjusted market capitalization (FAMC) and float-adjusted liquidity ratio (FALR) requirements.

Bovespa Index (IBOV Index) is adjusted to exclude Vale S.A. common and preferred stocks from the index, and represents the gross total return index weighted by free float market cap comprised of the most liquid stocks traded on the Sao Paulo Stock Exchange.

Exchange Rate is the daily return of Brazilian Real in \$USD.

***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Source: Bloomberg L.P.

In re: Vale S.A. Securities Litigation

Calculation of Abnormal Returns Using the Modified Fama-French Three-Factor Model Including
(1) the S&P Metals and Mining Select Industry Total Return Index,
(2) the Bovespa Market Index, and
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Vale Preferred ADRs

Estimation Period: May 8, 2013 through May 7, 2014 (One Year Prior to Proposed Class Period) ^[1]

Panel A. Fitting the Modified Fama-French Three-Factor Model ^[2]

Regression: $R_{VALE, PFD} - R_F = \beta_0 + \beta_1(Mkt - R_F) + \beta_2(SMB) + \beta_3(HML) + \beta_4(\text{S\&P Metals \& Mining Select Industry Total Return Index}) + \beta_5(\text{Bovespa}) + \beta_6(\text{Exchange Rate})$

Period: 5/8/2013 - 5/7/2014

	Coeff.	StdErr	t-stat	p-value		
β_0	-0.0004	0.0009	-0.4141	0.6792	R-squared	56.79%
β_1	-0.0952	0.1579	-0.6029	0.5472	Adjusted R-squared	55.65%
β_2	-0.3320	0.2369	-1.4015	0.1624	S.E. of regression	1.38%
β_3	0.1324	0.2739	0.4833	0.6294	Sum squared resid	0.0430
β_4	0.5079	0.0868	5.8489	0.0000	Log likelihood	671.0413
β_5	0.6252	0.0880	7.1015	0.0000	F-statistic	49.5114
β_6	0.7725	0.1104	6.9981	0.0000		

Panel B. Calculation of the Abnormal Return(s) on Select Date(s)

Date	R _F	Mkt-R _F	SMB	HML	Industry	Bovespa	BRL in USD	Predicted Return	Actual Return	Abnormal Return	t-stat	p-value	Sig
Remaining Misrepresentations and/or Omissions in the Amended Complaint													
5/8/14	0.00%	-0.26%	-1.00%	0.34%	-1.11%	-1.12%	0.13%	-0.80%	-1.54%	-0.74%	-0.539	0.590	
11/16/15	0.00%	1.39%	-0.58%	0.46%	1.37%	0.84%	0.69%	1.84%	-0.61%	-2.44%	-1.770	0.078	*
Remaining Partial Corrective Disclosures in the Amended Complaint													
11/6/15	0.00%	0.14%	0.81%	0.27%	-0.87%	-2.09%	0.23%	-1.86%	-4.12%	-2.26%	-1.641	0.102	
11/30/15	0.00%	-0.47%	0.14%	0.69%	0.96%	-1.44%	-0.58%	-0.80%	-9.46%	-8.66%	-6.277	0.000	***
12/21/15	0.00%	0.74%	-0.18%	-0.06%	1.22%	-1.21%	-0.76%	-0.78%	-3.57%	-2.79%	-2.025	0.044	**

Notes:

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^[2] Modified Fama-French Three-Factor model was run with the White heteroskedasticity adjustment for heteroskedasticity-adjusted standard errors.

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Exchange Rate is the daily return of Brazilian Real in \$USD.

***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Source: Bloomberg L.P.

In re: Vale S.A. Securities Litigation

Calculation of Abnormal Returns Using the Modified Fama-French Three-Factor Model Including
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(2) the Bovespa Market Index, and
(3) the Daily Return of Brazilian Real in \$USD

Vale Common ADRs

Estimation Period: **May 8, 2014 through November 27, 2015 (Proposed Class Period)**^[1]

Panel A. Fitting the Modified Fama-French Three-Factor Model^[2]

Regression: $R_{VALE,COM} - R_F = \beta_0 + \beta_1(Mkt - R_F) + \beta_2(SMB) + \beta_3(HML) + \beta_4(\text{S\&P Metals \& Mining Select Industry Total Return Index}) + \beta_5(\text{Bovespa}) + \beta_6(\text{Exchange Rate})$

Period: 5/8/14 - 11/27/15

	Coeff.	StdErr	t-stat	p-value		
β_0	0.0000	0.0012	-0.0359	0.9713	R-squared	52.09%
β_1	-0.4021	0.2026	-1.9852	0.0479	Adjusted R-squared	51.28%
β_2	-1.3042	0.2617	-4.9829	0.0000	S.E. of regression	2.28%
β_3	-0.3853	0.3389	-1.1371	0.2563	Sum squared resid	0.1861
β_4	1.0168	0.0882	11.5235	0.0000	Log likelihood	862.8076
β_5	0.5496	0.0901	6.0972	0.0000	F-statistic	64.6865
β_6	0.3229	0.1241	2.6020	0.0097		

Panel B. Calculation of the Abnormal Return(s) on Select Date(s)

Date	R _F	Mkt-R _F	SMB	HML	Industry	Bovespa	BRL in USD	Predicted Return	Actual Return	Abnormal Return	t-stat	p-value	Sig
Remaining Misrepresentations and/or Omissions in the Amended Complaint													
5/8/14	0.00%	-0.26%	-1.00%	0.34%	-1.11%	-1.12%	0.13%	-0.43%	-1.33%	-0.90%	-0.393	0.695	
11/16/15	0.00%	1.39%	-0.58%	0.46%	1.37%	0.84%	0.69%	2.09%	0.25%	-1.84%	-0.805	0.421	
Remaining Partial Corrective Disclosures in the Amended Complaint													
11/6/15	0.00%	0.14%	0.81%	0.27%	-0.87%	-2.09%	0.23%	-3.18%	-5.69%	-2.52%	-1.102	0.271	
11/30/15	0.00%	-0.47%	0.14%	0.69%	0.96%	-1.44%	-0.58%	-0.26%	-5.60%	-5.34%	-2.340	0.020	**
12/21/15	0.00%	0.74%	-0.18%	-0.06%	1.22%	-1.21%	-0.76%	0.29%	-4.06%	-4.35%	-1.905	0.058	*

Notes:

^[1] Regression excluding two misrepresentation and/or omission dates (5/8/14, 11/16/15), and two partial corrective disclosure dates (11/6/15, 11/30/15).

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***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Source: Bloomberg L.P.

In re: Vale S.A. Securities Litigation

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Panel A. Fitting the Modified Fama-French Three-Factor Model^[2]

Regression: $R_{VALE, PFD} - R_F = \beta_0 + \beta_1(Mkt - R_F) + \beta_2(SMB) + \beta_3(HML) + \beta_4(\text{S\&P Metals \& Mining Select Industry Total Return Index}) + \beta_5(\text{Bovespa}) + \beta_6(\text{Exchange Rate})$

Period: 5/8/14 - 11/27/15

	Coeff.	StdErr	t-stat	p-value		
β_0	-0.0006	0.0012	-0.5237	0.6008	R-squared	44.83%
β_1	-0.3273	0.1933	-1.6927	0.0914	Adjusted R-squared	43.39%
β_2	-1.0949	0.2462	-4.4464	0.0000	S.E. of regression	2.10%
β_3	-0.4879	0.2915	-1.6738	0.0951	Sum squared resid	0.1012
β_4	0.8877	0.0836	10.6144	0.0000	Log likelihood	580.2151
β_5	0.5173	0.0906	5.7079	0.0000	F-statistic	31.0159
β_6	0.4484	0.1166	3.8439	0.0001		

Panel B. Calculation of the Abnormal Return(s) on Select Date(s)

Date	R _F	Mkt-R _F	SMB	HML	Industry	Bovespa	BRL in USD	Predicted Return	Actual Return	Abnormal Return	t-stat	p-value	Sig
Remaining Misrepresentations and/or Omissions in the Amended Complaint													
5/8/14	0.00%	-0.26%	-1.00%	0.34%	-1.11%	-1.12%	0.13%	-0.55%	-1.54%	-0.99%	-0.470	0.638	
11/16/15	0.00%	1.39%	-0.58%	0.46%	1.37%	0.84%	0.69%	1.85%	-0.61%	-2.46%	-1.170	0.243	
Remaining Partial Corrective Disclosures in the Amended Complaint													
11/6/15	0.00%	0.14%	0.81%	0.27%	-0.87%	-2.09%	0.23%	-2.87%	-4.12%	-1.25%	-0.593	0.554	
11/30/15	0.00%	-0.47%	0.14%	0.69%	0.96%	-1.44%	-0.58%	-0.54%	-9.46%	-8.92%	-4.242	0.000	***
12/21/15	0.00%	0.74%	-0.18%	-0.06%	1.22%	-1.21%	-0.76%	0.04%	-3.57%	-3.61%	-1.719	0.087	*

Notes:

^[1] Regression excluding two misrepresentation and/or omission dates (5/8/14, 11/16/15), and two partial corrective disclosure dates (11/6/15, 11/30/15).

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Source: Bloomberg L.P.